Water spectrum

issues·choices·actions

STR.

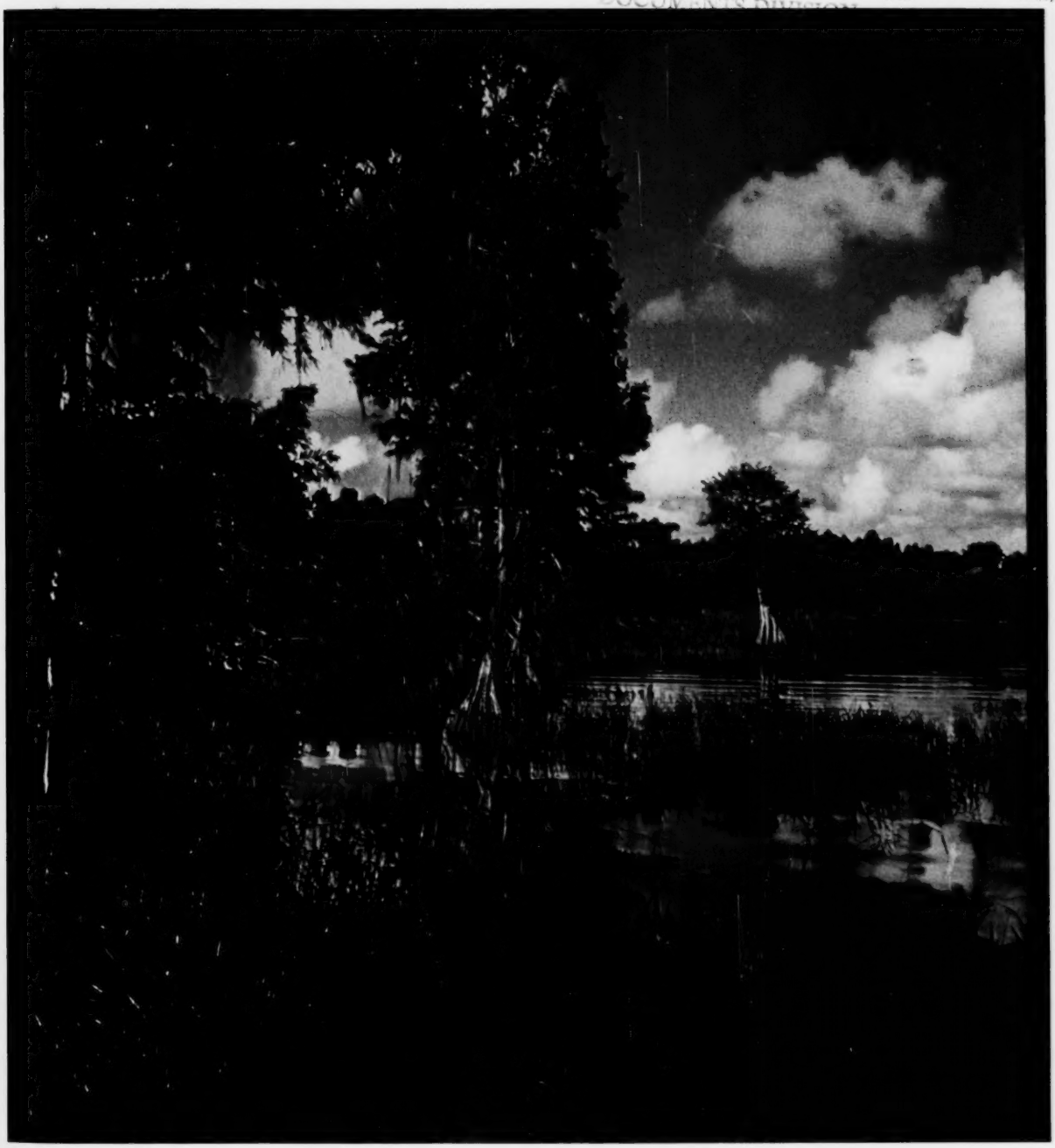
PROPERTY OF
PRINCETON UNIVERSITY
LIBRARY

MAY 31 1972

MAY 29 1972

RECEIVED
DOCUMENTS DIVISION

WATER SCIENCE LIBRARY



DEPARTMENT OF THE ARMY, CORPS OF ENGINEERS

Spring 1972

Water spectrum
issues · choices · actions

Vol. 4 No. 1
Spring 1972

Secretary of the Army
Robert F. Froehlke

Chief of Engineers
Lt. Gen. F. J. Clarke

Director of Civil Works
Maj. Gen. Frank P. Koisch

EDITOR
Edwin E. Chandler

ASSISTANT EDITOR
Seymour Reitman

EDITORIAL ASSISTANT
Frederick McKinney

CONTENTS

1 **The Netherlands' Deltaproject: Its Environmental Impact**
by Ir. P. Santema

11 **Nature and Man and Water**
by Congressman Jim Wright

16 **Dredging Disposal: Real or Imaginary Dilemma?**
by Vyto L. Andreliunas and Carl G. Hard

22 **Let's Revitalize Water Planning**
by Ted Pankowski

30 **Walt Disney World and the Environment: An Ecological Challenge in Central Florida**
by Frederick W. Harden

36 **Population Control: NOT a Necessity in Water Management**
by Col. Robert R. Werner

43 **Events, Deeds and Deliberations**

Comments on topics in this publication are invited. Send to:
Editor, Water Spectrum
Office, Chief of Engineers
Department of the Army
Washington, D.C. 20314

Use of funds for printing this quarterly publication was approved by the Director of the Office of Management and Budget on January 6, 1972, with approval to publish through December 31, 1976.

A major purpose of this publication is to serve as a forum for the open discussion of issues and choices in resolving water resource problems. Views and conclusions expressed or implied do not necessarily reflect the position of the Corps of Engineers.

Subscription rate is $2.50 per year; 75 cents additional for foreign mailing. Price of a single copy is 70 cents. Order directly from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

This issue developed by Policy and Analysis Division, Directorate of Civil Works.

Address changes: Please attach old address label to request for changes.

COVER: Swamp and wildlife areas on the Walt Disney World property in Florida present environmental protection challenges.
For the story, see page 30.

In our last issue we had an article on port growth policies abroad, showing how other countries are facing problems related to water resources. This article about the Dutch Deltaplan is in a similar vein, covering aspects of an extensive undertaking of the Dutch Government to modify the various distributaries of the Rhine River.

The environmental impact of the Deltaplan will be extreme. It will change current brackish saltwater estuaries to either freshwater or brackish lakes. It will cause major physical shoreline changes. It will upset established fisheries of oysters, mussels and eels. It could change the heat balance of the Delta waters and modify previous weather patterns of fog, night frost and ice formation.

The Dutch Government recognized the probability of such changes when the plan was approved in 1958, but they could not quantify the changes at that time. Consequently, they began a program of major research to clarify the environmental impact and to develop operating criteria. They are continuing the research through the construction phase, and they plan to conduct further investigations and studies for use in operation of the Delta works and management of its resources.

Dike building comes early in the Netherlands.

Foto Henk Nieuwenhuijt

The Netherlands Deltaproject:

ITS ENVIRONMENTAL IMPACT

By Ir. P. Santema
Chief, Division of Water Management
Environmental Research and Planning
Rijkswaterstaat Deltadienst

In the southwestern part of The Netherlands a huge scheme for improvement of flood protection and water management — the so-called Deltaplan — at present is in a process of realization.

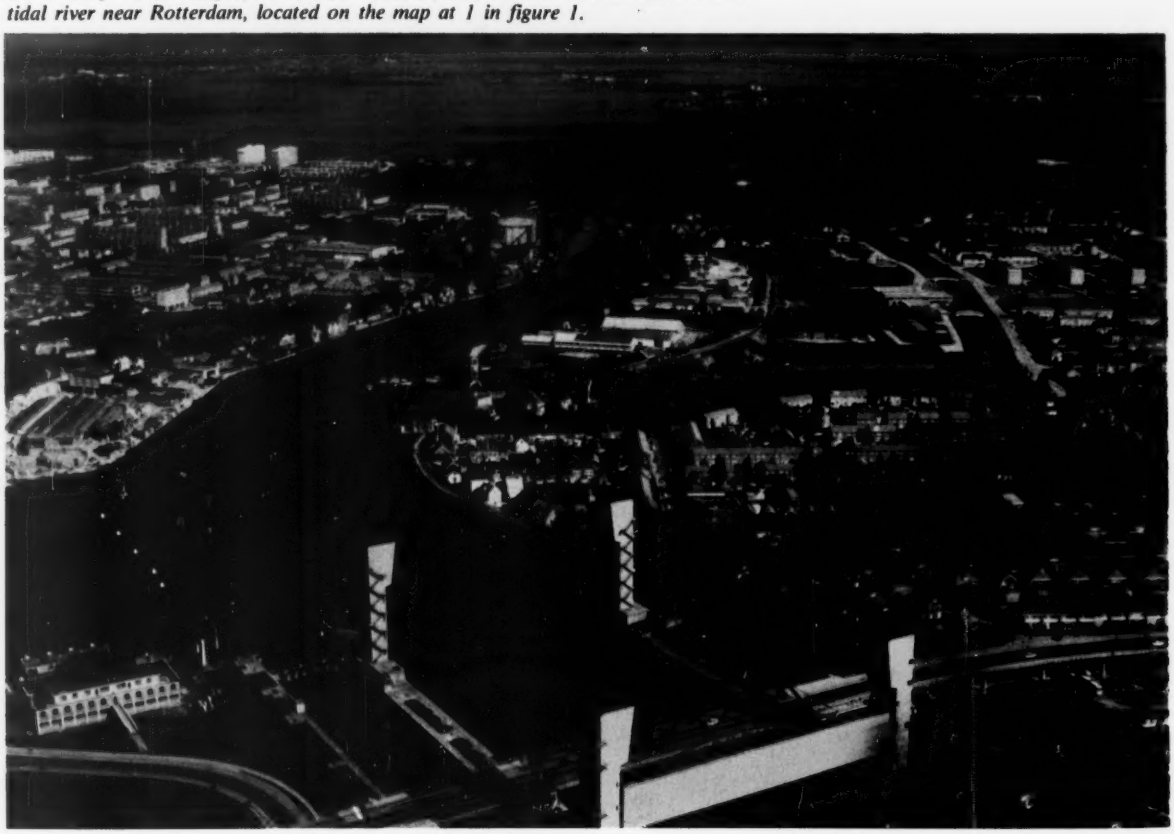
The first studies and plans for improvement of the situation existing before 1953 date back to the thirties. A number of smaller schemes, aiming at goals such as shortening of the coastline and improvement of water management and/or land reclamation programs were indeed realized in that period. The storm flood of February 1953, which devasted large areas in the southwestern part of The Netherlands, however, was the great impetus for the realization of major improvements that require considerable investments and, in many ways, deeply affect the area involved.

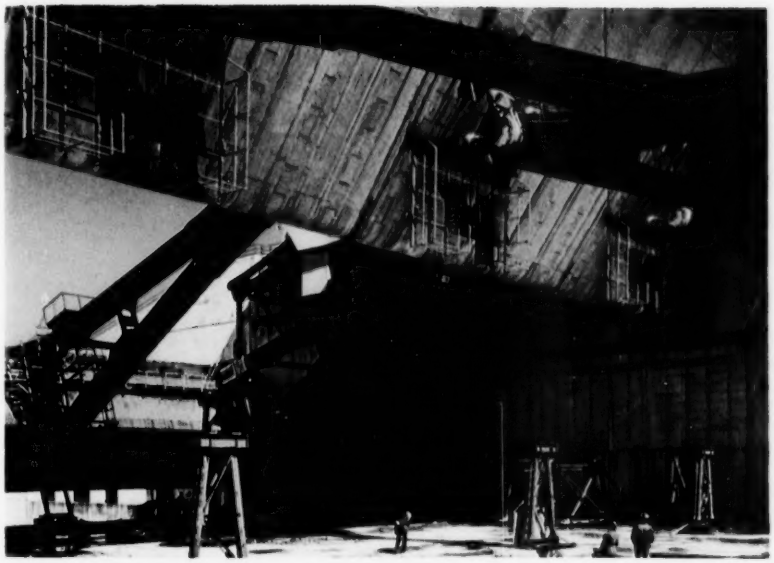
Immediately after the disaster of 1953 a commission of experts was appointed by the government to study the problems and to draw up recommendations for action to be taken. After extensive multidisciplinary studies, in which a large number of persons and organizations participated, the commission recommended the Deltaplan, as it is known today. A law providing the necessary legal basis for the works to be undertaken, was adopted by the Netherlands' Parliament and became effective in 1958. The first major work under this scheme was inaugurated in the same year, with the last major dam scheduled to be completed about 1978.

The Deltaplan (figure 1) aims at the closure of a number of tidal rivers and estuaries (at points marked 1, 2, 3, 4 and 5) by use of movable flood barriers and dams. Due to preponderant navigation interests the Rotterdam Waterway and the Western Scheldt will remain open, so that the existing dike system along these and the connecting rivers needs to be heightened and strengthened. In order to avoid the occurrence of too strong tidal currents and the various adverse effects thereof, the Delta scheme includes the building of a number of secondary dams (at points 6, 7, and 8 of figure 1). In one of the dams a major complex of sluices has been built for the evacuation of the floodwaters of the Rhine and the Meuse Rivers. In other dams, locks have been built for inland navigation. Finally, intake works and discharge sluices will be built as required for water management on the enclosed water basins.

The former estuaries may be transformed wholly or partly into fresh water basins and play a role in the water supply for domestic, industrial and agricultural purposes. The enclosed water basins, with the former tidal lands, sandbanks, etc., offer various possibilities for the establishment of nature reserves and for the realization of facilities for outdoor recreation. In this connection it is of great importance that the various dams of the Deltaplan form more or less a starting point for the development of a new system of road connections. With initiation of the

Structures for the Deltaproject include movable flood barriers such as this one in a tidal river near Rotterdam, located on the map at 1 in figure 1.





A complex of sluice gates evacuates flood waters on the Rhine and Meuse Rivers. This is one of seventeen at the Haringvliet Dam. Weight of the gates average 600 tons each.

This brushwood mattress will sink to the seabed to prevent erosion by incoming and outgoing tidal flows when an estuary is closed off.

Deltaplan, the formerly isolated central deltaic area will become more integrated with the surrounding area, which has been subjected to an accelerated process of industrialization and urbanization since the fifties. Although the intention is that the more open character of the central deltaic area will be preserved, in the future the area will be in a better position to fulfill essential functions within a larger, highly developed region.

The realization of the Deltaplan means — directly or indirectly — a drastic and rather abrupt change in the environmental conditions in the deltaic area proper of the Rhine, the Meuse and the Scheldt.

The geography of the deltaic area, prior to the beginning of the Delta works, was the result of rather gradual natural processes of delta formation and the engineering activities of man since the earliest historical times. These activities included the diking of those tidal lands where the natural processes of sedimentation had raised the level of the land sufficiently above mean sea level. Success normally was guaranteed only in those cases where man's activities did not interfere too much with the forces of nature. However, it often happened that afterwards large areas of these diked lands were regained by the sea, temporarily or permanently. For the years 1300 to 1950, for example, the total land area increased only slightly, but the area of diked land was increased considerably with the contrasting result that the area of tidal land decreased drastically.

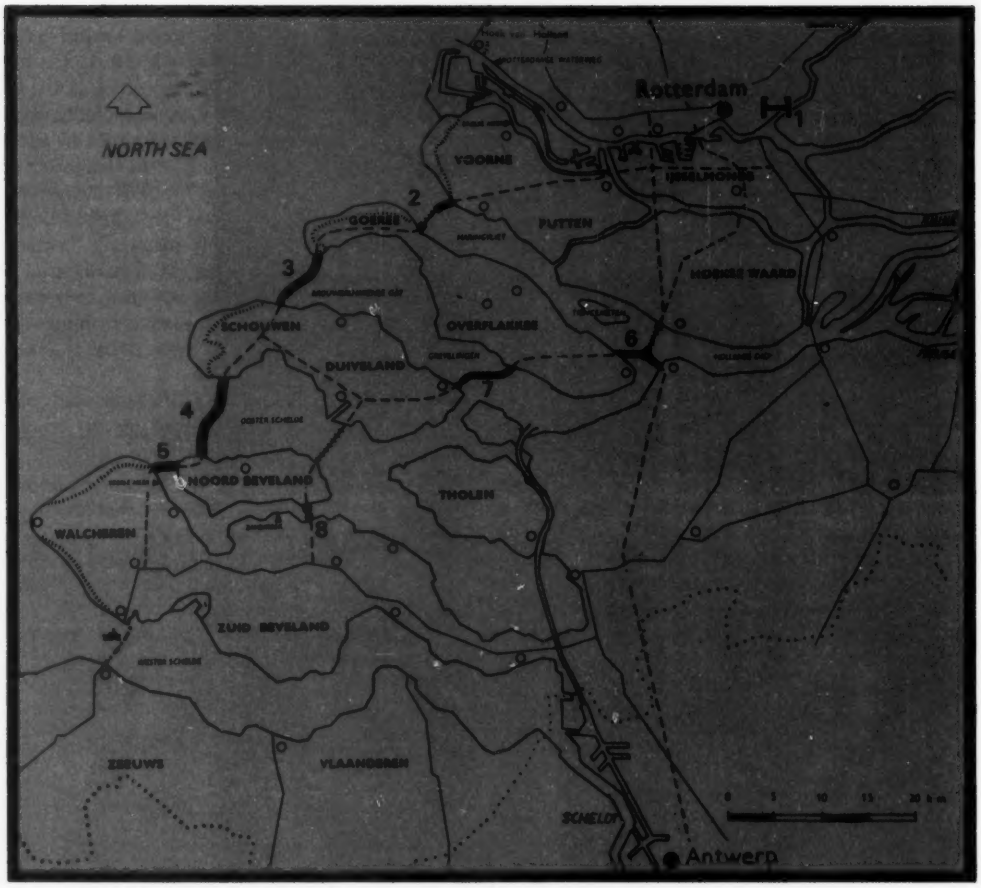


Fig. 1. The deltaic area in the southwestern part of the Netherlands is where construction for the Deltaproject is underway.

The realization of the Deltaplan means that the former tidal lands, land inward of the primary dams, will be no longer subject to the influence of the tides, while in the greater part of the deltaic area salt or brackish water will be replaced by fresh water. Furthermore, an additional area of sandbanks and more silty areas, which previously flooded every tide, will become permanently dry land. Compared to the rather gradual changes in earlier times, the situation created by the various phases of the Deltaplan comes as a shock to the environment. This is reflected, for example, in the changes in the natural vegetation of the tidal lands. With the decay of the original vegetation pattern, a period of general impoverishment of the biosphere begins. However, in the course of time, under the then existing natural conditions, new species appear again and their degrees of abundance move through chronological time in the form of waves (figure 2). Soon, enrichment leading towards a new equilibrium sets in and the ultimate result may be a new, attractive, natural vegetation pattern. Experience shows, however, that these natural processes take much time, and also that nature may be assisted by the creation of certain manmade variations or gradients in the natural conditions and by carefully designed management programs. In areas which have a more direct function for outdoor recreation the natural vegetation, moreover, will have to be supplemented to a greater or smaller extent by adding artificial greenery elements.

The environmental impact of the Deltaplan also affects birdlife. The deltaic area as it was prior to the beginning of the Deltaworks fulfilled essential functions for the bird population of Western Europe. Especially its function as a key element in the migration routes of birds may be mentioned here. The establishment of nature reserves on former tidal lands, sandbanks, silty areas, etc., with refugia for birds and the application of carefully designed management programs, may compensate at least partly for the losses causes by the environmental changes. Ten years of experience in one of the smaller estuaries which was cut off from the sea already in 1961 teaches that very gratifying results may be obtained in this way. Moreover, it is expected that on the sea side of the primary dams new areas of shallow water as well as silty, sandy, and dune areas will emerge in due course as a result of mor-

phological changes in the coastal area. These areas may then take over a number of natural functions which earlier were fulfilled by land and land water zones landwards of the primary dams.

The changes which will take place in the coastal area form a very interesting, somewhat puzzling feature of the Deltaplan. *The damming up of the estuaries will affect considerably the pattern of currents in the coastal area.* This in turn will affect the pattern of sedimentation and erosion, with the ultimate result that the area of the shallow underwater delta in front of the estuaries will decrease, causing the underwater "shoreline" of the North Sea to move landward. The changes in the configuration of the sea bed will affect the wave pattern in the coastal zone and thus alter the sediment-transport pattern. As an ultimate result of these interrelated effects a new coastline will be formed between the western heads of the islands, in front of the primary dams. At present two-dimensional tidal computations and also computations as to the sediment-transport, as well as model experiments, are being carried out in an attempt to determine more exactly which type of coastline will emerge and which rate of development may be expected.

It goes without saying that *the Deltaproject will have important hydrological and hydrobiological effects.* With the transformation of the former estuaries into freshwater basins new possibilities will be created for an adequate water supply for domestic, industrial and agricultural purposes. For reasons of controlled water quality the domestic water supply requires separate basins or reservoirs, in which a fluctuation of water level may make up for interruptions of the intake of water. The new possibilities will improve the often precarious situation in which the water supply of the southwestern part of the country finds itself nowadays. To this end the delta basins will be flushed with river water both in the period of desalinization and later on for water quality control. An enormous problem, however, is the quality of the river water to be used.

Under the previous conditions the estuaries were filled with clean, salt to brackish water and formed a rich hydrobiological environment. Under future conditions this rich marine-estuarine hydrobiological environment will be replaced by a fresh water environment causing a flourishing oyster culture to be lost. The fresh water environment, however, will have various water quality problems. The raw material for intake in the delta basins is namely Rhine water and a smaller quantity of water from the Meuse. The quality of the Rhine water at the place where it enters Dutch territory is extremely bad, especially at low discharges of the river when it has a low concentration of oxygen and heavy loads of organic and inorganic substances, including oil products, heavy metals and pesticides.

The Deltaproject will change salt water to fresh or brackish water, affecting fisheries for oysters, mussels and eels. Recreation boats will replace commercial fishing boats.

Foto KLM Aerocarto

The Deltaproject includes locks for inland navigation. This one is among the largest locks in Europe's inland waters.

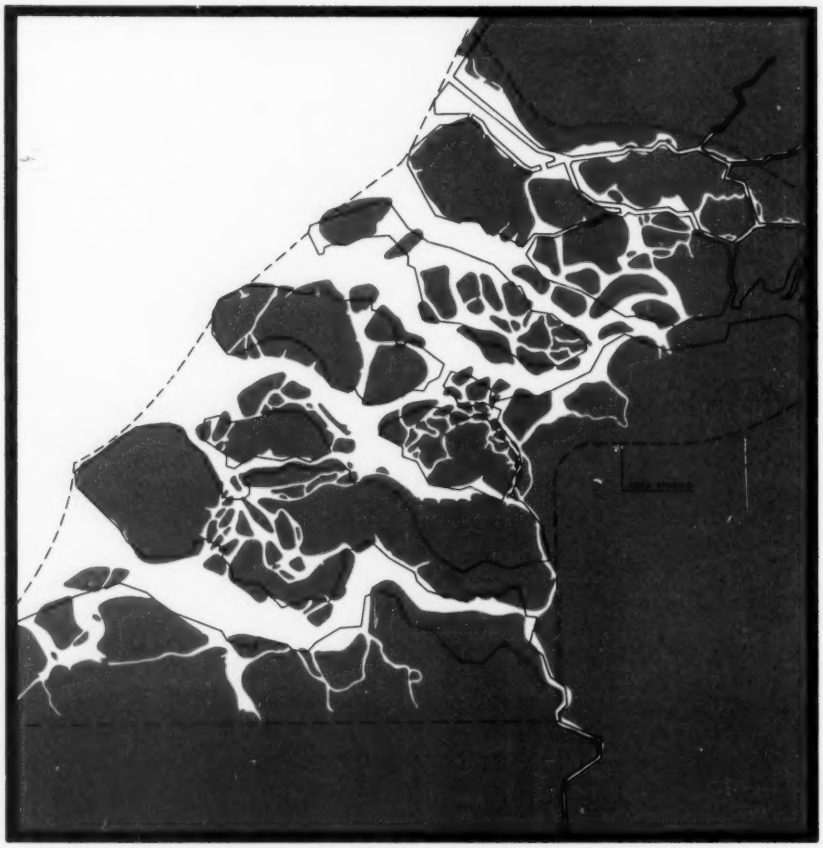
A cableway carries concrete blocks to close the remaining gap in a major dam for flood protection (at 2 in figure 1).

A continuous row of caissons fills the entire gap, and with gates raised the tidal current is passing through the openings (at 7 in figure 1).

Pictures furnished by Netherlands Information Service, New York, N.Y.

The gap at point 1 will be closed by concrete blocks dropped from a cable-car hoist. The gaps at points 2 and 3 will be closed with sluice caissons.

All the sluice gates are closed to permit dredging operations. Later, the 17 seaward gates and 17 landward gates will be raised to allow tidal currents to pass through. The roadway over the dam will permit vehicle traffic between the islands.



The deltaic area in the Netherlands in 1300 is depicted here in the shadowed sections, and the black lines show the diked areas at present, transforming the countryside into scenes such as the one below.

Foto KLM Aerocarto

From the place where this water enters the deltaic area proper the current velocity decreases gradually and the time which a water particle needs to cover a certain distance increases. In these stretches of the rivers a considerable self-purification of the water takes place. Thus, while time is an important element therewith, the sedimentation of silt is also of great importance. As an example, the silt concentration in the Haringvliet (see figure 1), e.g., decreased to roughly one-tenth of the concentration before the damming up of this estuary. With the sedimentation of the silt a large proportion of the concentration of heavy metals and pesticides also is removed from the water.

A program of special studies is under way at present, both as to the processes taking place in the bottom silt, between the bottom and water phases, and as to the erodibility of the silt under conditions of high river discharges. At the intake of the southern delta basins the water quality may be suitable enough; the phosphate concentration, however, is still much too high to avoid algae blooms. Therefore, means are being studied at present for large scale phosphate removal, preferably by adding iron sulphate to the intake water (rate of intake 150 to 300 m³/sec). In the southern delta basins a further self-purification of the water will take place and, depending on the place, the water will be suitable for the more exigent uses such as recreation.

The water of the delta basins has to fulfill various functions, however. One of these functions is to serve as inland waterway, since the locks in the dam in the Volkerak (at 6 in figure 1) annually pass more than 130,000 ships with 50 million tons of freight. Certain systems for prevention of salt water intrusion must be applied at the locks to the estuary of the Western Scheldt. All these systems also involve a certain loss of fresh water in the future that in total may increase to the order of 100 m³/sec for the southern delta basins. An indirect effect of the inland navigation is thus a compulsory intake of water into the southern delta basins, even during periods when, for reasons of water qualtity, intake would be less desirable. Inland navigation further means a certain degree of water pollution and a risk of accidents. Therefore, it has been proposed to make a further subdivision of the delta basins, according to the various primary functions that a particular water has to fulfill; and according to water quality criteria which can be met. Within this concept it might be even possible to maintain one of the subbasins as a salt water basin.

A problem which, in the future, will come more to the forefront is the thermal load of the delta waters caused by the discharge of cooling water by power plants. A fairly large part of the total installed capacity of power plants in The Netherlands (80,000 to 100,000 MW in 2000) will be needed in the southwestern part of the country. It may be even expected that, in view of the relatively favorable cooling conditions here, electricity will be "exported" from the delta to a wider region. The problems connected with the heating of water with various degrees of pollution are, therefore, also a subject of the program of studies.

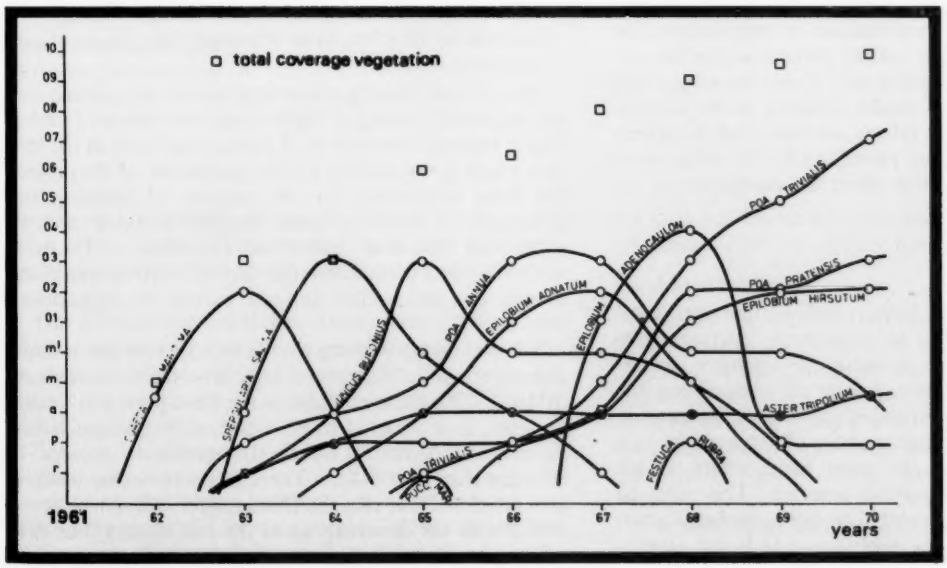


Fig. 2. This graph represents the variation in the number of plants of various species surviving on a former sandbank after enclosure of a delta estuary in 1961. Note the rise and fall of some species and the leveling off or upward trend of others.

Luchtfoto Bart Hofmeester

Part of the lands formerly subjected to the tides will be preserved as natural reserves.

Specifically, the design of a phased masterplan for the establishment of power plants will be taken in hand.

The discharge of cooling water on the other hand helps to alleviate the problem of ice formation on the waters of the delta in severe winters. The replacement of the salt or brackish water by fresh water in the delta basins is favorable for increased ice formation. The damming up of the estuaries blocks the exhange of heat with the North Sea and thus affects the heat balance of these waters. The effect of the Deltaproject on ice formation, on the occurrence of night frost and fog, etc., is also the subject of a program of studies. The results obtained so far demonstrate clearly that certain effects are there, but it appears that, under the conditions prevailing in the delta, there will be no overall negative effect on navigation or on agriculture.

From the foregoing lines it follows that the Deltaproject will have an important environmental impact, necessitating a program of intensive investigations and studies which will form the basis of possible supplementary and compensating provisions. The project, which comprises a continuous series of large works in a period of 25 years, on the other hand, offers unique possibilities for environmental research. This may be demonstrated by the following listing of a number of characteristics of the various subbasins which are already available for research:

- a fresh water basin, Brielse Meer, (dammed up in 1950, an area 4 km², average depth 5 m, greatest depth 15 m, local drainage area, intake of Rhine water);
- a brackish basin, Veerse Meer, (dammed up in 1961, an area of 18 km², average depth 6 m, greatest depth 25 m, local drainage area, intake of salt estuarine water);
- a fresh water basin, Haringvliet, (dammed up in 1970, an area 120 km², average depth 5 m, greatest depth 40 m, local drainage area, flushed by waters of the Rhine and the Meuse);
- a brackish to salt water basin, Grevelingen, (dammed up in 1971, an area 115 km², average depth 5 m, greatest depth 45 m, local drainage area, intake of salt estuarine water).

The various investigations and studies are carried out by teamwork among a fairly large number of existing Dutch research institutions. A rather small unit in the service which is responsible for the realization of the project has been established for the purpose of ensuring the coherence of this combined research program and to make sure that it is carried out on schedule. The unit stimulates and coordinates the various environmental investigations and studies, and also carries out supplementary tasks.

Environmental problems nowadays receive much more attention than in the years shortly after the flood disaster of 1953. The basic concept of the Deltaplan still today, however, is considered to be sound, although opposition against the damming up of the remaining estuary is stronger than ever before. There is, on the other hand, a general conviction that the Deltaproject will not be completed with the damming up of the last estuary, but that various carefully designed supplementary or compensating provisions will have to be made. ■

nature man water

"Water — nature's most priceless gift and man's most useful servant."

By The Hon. Jim Wright
Chairman, Subcommittee on
Investigations and Oversight,
House Committee on Public Works

The Book of Genesis commands man to "subdue the earth," not ravage it. Equally significant, this injunction does not even hint that man should allow the earth to subdue him.

This Biblical commandment simply means that nature, like the human body, should be perceived as a marvelous mechanism engineered and created by the Divine Intelligence to perform its appointed functions efficiently and effectively.

But just as the human body can get out of balance and require corrective surgery to perform its functions properly, so also nature itself can get out of balance and require the corrective, healing surgery of man to perform its functions effectively, efficiently, and beneficially in the interests of both nature and man.

Nature exists for man, and man is expected to exercise beneficent dominion.

He is not expected to prostrate himself supinely before the floods; not to abandon the arid earth to dust where water lies beneath the soil; nor let the waters wash away the land and leave both man and earth bereft. All of our knowledge cries out against such folly.

Parable of the Dam

Recently George W. Ball, former Under Secretary of State, wrote a whimsical little story which he called the "Parable of the Dam." It was published in *Newsweek* magazine. Secretary Ball no doubt intended its deeper meaning to apply to the world of international affairs. But the parable has a more direct and even more obvious application in light of recent developments in the United States.

The story goes like this:

Since the beginning of time, the villages in a mountain canyon had been periodically ravaged by floods. Finally, the leaders convened a great meeting and decided to invest their efforts and resources in building a large, strong dam.

Thereafter, for a quarter of a century, the dam sheltered the villages from disaster, prosperity

prevailed, and life was tranquil — until, at last a new generation began to grow up, free from the apprehensions of the past and filled with exciting ideas about a world of song and beauty.

Inevitably the new leaders turned their attention to the dam. It was, they announced, huge and ugly and an affront to the environment. Besides it blocked out the sunset.

One leader wrote a folk song proclaiming it a symbol of imperialist megalomania, and people spoke excitedly of little else, until someone brought forth an argument that seemed quite unanswerable. After all, it was pointed out, no one ever talked about flood damage except the old fogies over 30 who were not to be trusted anyway. Who among the new leaders could recall any floods in his lifetime?

It was perfectly clear that floods were completely outmoded, a matter of the past — perhaps just a fiction manufactured to frighten the people. Since there had not been one for 25 years, clearly there would not be another.

So, after a season of demonstrations, more speeches, a pageant and several rock festivals, they blew up the dam and used the fragments for a people's playground. And let me tell you straight, man, when the waters came down it was really the Age of Aquarius!

The "Ecology" Movement

In the past two years, a sudden public awareness of our environment has burst upon the scene like an earthquake. To those who for decades have led the lonely and often thankless struggle for conservation and environmental quality, this should be great good news. A public awakening was long overdue! But — as is so often the case — the price we pay for long public neglect is a sort of hysterical over-reaction.

Unfortunately, among the new converts there is vast misunderstanding of all that the dedicated handful of conservationists has been doing for all these years. There is a deadly tendency to want to stop everything, to tear out all that man has built, to reverse the hard-won victories the conservation movement has achieved, and — incredibly — to turn the clock back to the unenlightened era when nature ravaged man and man was powerless to protect himself.

For many in the newly popular "ecology" movement, scapegoats have become more popular quarry than solutions. Stopping programs of resource development has become more fashionable — and it was always easier — than performing those programs.

Environmental Policy Act

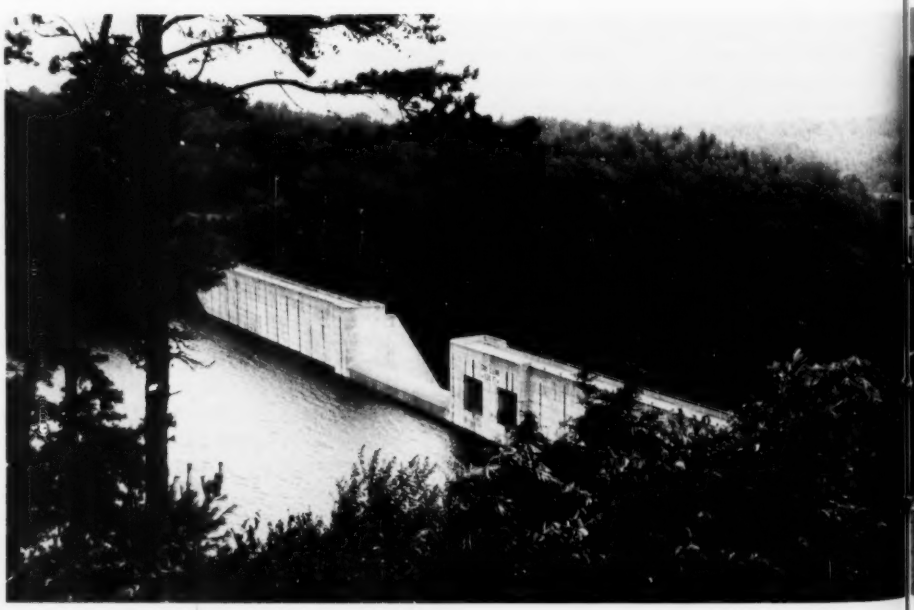
For some the Environmental Policy Act of 1969 has been misconstrued as a trumpet call to retreat into the past and seek the improbable goal of a dead and distant age before man's massive intrusion, when nature was supreme — an age when floods were thought to be the inevitable will of God and when it was the accepted rule that a river would cleanse itself in seven miles without any help from man.

But those who so interpret the commandment of that legislation have failed to understand its meaning. And this misunderstanding exists not only among the enthusiasts of the preservationist movement, but among some in our agencies of administrative government — and, sadly, in some of our Federal courts.

Let me quote the purposes of the Environmental Policy Act as set forth in the very preamble to that legislation. These are the purposes declared by Congress:

> "To declare a national policy which will encourage *productive and enjoyable harmony* between man and his environment (and I emphasize those words, productive and enjoyable harmony); to promote efforts which will prevent or eliminate damage to the environment and biosphere and *stimulate the health and welfare of man;* to enrich the understanding of the ecological systems and natural resources *important to*

Use of water for hydroelectric power has positive effects.



the Nation; and to establish a Council on Environmental Quality."

Nowhere do I read in these purposes any intent to halt the development of our Nation's water resources.

Nowhere do I see expressed a desire to lock up our rivers for the exclusive enjoyment of those few who wish only white-capped waters running rampant and uncontrolled.

Nowhere in that legislation is implied a call for retrogression. The law contains no mandate for any self-appointed group to exalt itself above the established agencies of orderly government and bring their work to a grinding halt!

Nowhere in that law do I read any intent to abrogate the clear will of Congress as reflected in water development projects fully authorized for construction — and some of them already begun — by the Bureau of Reclamation, the Soil Conservation Service, and the Corps of Engineers.

Yet, sadly, some have mistakenly read into the passages of that law a commandment to do these very things.

Man's Experience

My father once told me that, unless each generation can capitalize upon the *mistakes* of its predecessors and avoid a *repetition* of those same mistakes, we'd suffer the greatest waste of all — the waste of man's hard-won experience.

Many of us are not so young that we cannot recall the ups and downs of an uncontrolled public economy, the booms and busts of an unprotected farm economy, the flickering lights of rural America where electrification was only a dream, or the devastating floods and droughts inflicted by a nature uncontrolled by man.

The Environmental Policy Act provides the machinery for a valuable service — new tools to evaluate the environmental effect of each of our public decisions. Congress most emphatically *did not* intend that only the *adverse* effects of every act should be subject to evaluation. To adopt such an attitude would lead us to but one conclusion: do nothing!

A Balanced View

It was quite clearly intended by Congress that the machinery originated in that act should give us the information for a *balanced* view.

While we do want to know of any possible effects on wildlife, we are preeminently concerned with the effects on *human* life. That, in any sane scale of values, must always come first!

Obviously, when navigation opens up the gates of commerce and job-producing enterprises to an underdeveloped area and helps reverse the massive tides of migration to the overcrowded cities, the environmental effect is *positive*!

When the Soil Conservation Service builds levees and up-stream dams and encourages terracing and cover cropping to retard the siltation of our reservoirs, the environmental impact is *positive*!

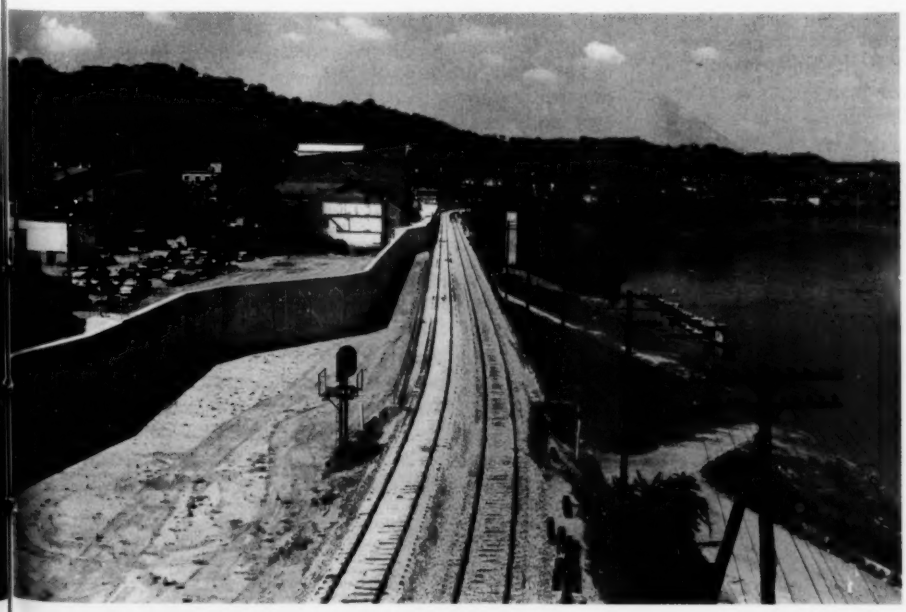
When homes and businesses are saved from periodic floods and the human wreckage that lies in their wake, who can regard the environmental effect as anything but *positive*?

When the waters of subterranean streams bring forth their bounty and transform deserts into gardens where the family of man can live and prosper, the environmental impact is *positive.*

When a city is given a dependable water supply, the living environment is *enriched.*

When a reservoir provides the means of wholesome outdoor recreation for thousands of city-bound Americans, the environmental quality has been *enhanced.*

When the management practices of enlightened man augment low flows downstream, stabilize the river banks and replace the stagnant pools where only mosquitoes have bred, the environment quite manifestly has been improved.



Floodwalls which protect residences and stores have a positive impact.

Each of these effects is *positive* and *helpful* to the human race. Congress most emphatically does not intend that any one of them shall be slighted or ignored.

Congressional Intent

Last year in Congress we had two votes which clearly established the will of the people's elected representatives.

The first came upon an amendment to the Agriculture appropriation bill which would have directed that we halt all works of channelization including those already approved by Congress and subject them all to further "study."

The second came upon a motion to amend the Public Works appropriation by stopping the development of a key project in the Delaware River program — one on which construction already had begun — until further vaguely defined "studies" might be conducted.

Both amendments were decisively defeated! And this should be an unmistakable expression of the clear intent of Congress that the soundly conceived works of water resource development shall go forward unimpeded!

The projects which would have been delayed or denied by these amendments had already been studied and restudied. They had been analyzed, evaluated, adopted and begun — just as numerous others against which well-meaning but pitifully misinformed minorities have sought injunctions in the courts.

It is devoutly hoped that the courts will understand the intent of Congress as expressed in these resounding votes and govern themselves accordingly.

Study No Substitute for Action

There comes a point in every human society when study must give way to action. The average water resource development project of the Corps of Engineers today must traverse the labyrinthine path of almost 18 years of study and restudy between the point of a survey resolution and the turning of the first spadeful of dirt.

To suggest that, after all this, the will of Congress be stymied and the directed action be stalled simply for the sake of further "study" is reminiscent of the words of Kipling in his description of old men. He said:

> "They peck out, dissect, and extrude to the mind
> The flaccid tissues of long-dead issues
> Offensive to God and mankind
> Like vultures over an ox
> That the Army has left behind."

Study at best is merely a guide and precursor to action. It is not a substitute for action!

Conservation and Development

Conservation and development are not mutually exclusive. Development of the earth's resources is the tool by which man carries out the goal of conservation.

There is no irreconcilable gulf between a sound ecology and a sound economy.

Wholesome recreation which people enjoy on manmade lakes is a positive matter.

To be a wise conservationist or an intelligent environmentalist does not mean to halt our development and harnessing of the water resources of our planet. To greater or lesser degree this has been necessary since man first intruded upon the earth. It is more necessary today than ever because there are more and ever more people.

We cannot, alas, keep people from intruding upon the earth. And the interest of people must come first.

Population Pressures

Already the stark statistics of population growth contain in their overtones a prophecy of world famine. Already, in spite of our pockets of affluence, we see a preview of this prophecy on the subcontinent of India.

At the beginning of the Christian era, there were only some 250 million people on the entire earth. Within our generation, we shall have more than that right here in the United States on about seven percent of the world's land area.

It took mankind more than 3,000 years to achieve a population of three billion people. Demographers forecast that we shall double this in 30 years. In three decades, if the present trend continues, we shall add to the living total as many as our progenitors added in more than three millennia.

The same amount of land and air and water and mineral resources, then, must be made to serve more and ever more people. Every year in our own country, we have a population growth equivalent to a new State of Maryland.

Not much longer can agricultural surpluses be our problem in the United States. Instead, we rapidly approach the time when we shall need millions of additional acres in production if we are merely to feed our own people — let alone the famine-bent billions of a hungry world.

Every drop of water that we can conserve, every inch of top soil we can save, every field and forest we can renew, every ore and mineral we can develop and conserve, and every stream we can cleanse of pollution will be our greatest possible gifts to future generations. And this is why the development of our resources must never slacken.

Productive and enjoyable harmony between man and his environment is what legislation encourages.

As most of you know, this Nation used only about 40 billion gallons of water a day in 1900. This year we will use more than 400 billion gallons daily. The entire structure of our modern life depends, therefore, upon the maximum development and conservation of this finite resource.

Nature's Endowment and Man's Choice

The amount of water in the world is constant — unvarying and abundant. The total quantity has been precisely the same since the very beginning when

> . . . God created the heaven and the earth.
> And the earth was without form and void;
> and darkness was upon the face of the deep.
> And the spirit of God moved upon the face
> of the waters.

An unending cosmic rotation steadily moves man's lifegiving liquid by gravity through the gentle and incessant flow of streams to the great reservoirs of our oceans, then draws it skyward by the sun's attraction to be purified anew, conveys it by cloud and wind, and returns it by rain to refresh the thirsty earth and renew man's lease on life . . . *ad infinitum.* It is an ever-recurring miracle, the most wondrous natural marvel of a wondrous universe.

Science can comprehend it, but never quite duplicate it: Man cannot change it. He can locally and temporarily befoul the process, and bring death. He can fail to act, quibble and quarrel with his neighbor while the tides of man outpace the provender of nature. Or he can form a sort of divine partnership with nature, help it along — and preserve life. This is his choice.

Twentieth-century America, like the prodigal son, has drawn heavily upon the bank account of its native endowment and squandered the substance in riotous misuse. More bountifully endowed than any nation in history, we've adopted the rather casual assumption that Providence protects America. We've extracted the riches of our natural legacy, exploited them to build a shining society, and wasted them in copious quantities.

We recall that other civilizations, also blessed with a spark of greatness, have strutted across the stage of world eminence only to fade and wane, their brief, bright promise unfulfilled. In the uncomprehending sand and heat of arid desert waste, their monuments lie buried.

Let no future archaeologist tell the story for us. We have the knowledge to tell it for ourselves — if we have the wisdom. There is *enough* water to serve our needs for future time, if we learn to use and reuse it well. And there is *enough* time to do what we must. But there's not much of either to spare. ■

dredging disposal:

Harbor maintenance calls for annual removal of millions of cubic yards of organic muds and other material.

real or imaginary dilemma?

By Vyto L. Andreliunas, Civil Engineer and
Carl G. Hard, Marine Geologist

Headlines in 1970 declared that 21 square miles of ocean bottom off Long Island, the New York Bight, had become a "dead sea."

Since then Thor Heyerdahl has expressed grave concern over a sharp increase in visible pollution along trade routes in mid-ocean during the period between voyages of Ra I and Ra II. Jacques Cousteau has estimated that the oceans are about "40 percent destroyed" and the swordfishing industry has been nearly eliminated because of recent concern over mercury content.

Danish delegates to the NATO Conference on the *Challenges of Modern Society* in 1971 stated that the Baltic Sea is already subject to such severe oxygen starvation as to be almost dead, and that the North Sea is rapidly becoming the same.

In the shadow of such pronouncements of doom there is a tacit assumption in many quarters that the disposal of dredged material, since it makes up the greater bulk of solid materials deposited in the ocean by man, constitutes a major source of pollution of the seas. However, Dr. Kenneth Emery of Woods Hole Oceanographic Institution, a marine geologist of international stature, recently contended that man has much more ocean floor to waste than dry land. Dr. Emery referred to the findings of an "intensive study" of the New York Bight industrial waste dumping ground which found "there have been practically no adverse effects from dumping in the Bight for the past 20 years," and concluded that we are better off to use the ocean floor for dumping wastes, provided of course that it can be done without severe ecological risks.

Dr. David Smith, another marine geologist and director of program development of the Dillingham Environmental Co., said at recent Senate hearings on ocean waste disposal that ". . . in the present era of aroused public interest in the environment, in which ecology has become virtually a 'motherhood issue,' there are certain significant hazards, both politically and professionally, in what at first may seem to favor what others might term pollution. . . . If we can recognize the ocean's ability to accept enormous volumes of waste, then the key decision is simplified. It becomes what type of waste can be put in the sea safely and what must be disposed of elsewhere — the waste assimilative capacity of the sea is enormous. I can hardly overemphasize that there has been a general failure to recognize this."

Dr. Smith estimates that *approximately 35 percent of dredged materials are polluted and the remainder are totally acceptable for sea disposal. As the effectiveness of nationwide water pollution control efforts grows, the proportion of acceptable, nonpolluted materials will increase.*

How valid is the criticism leveled at sea disposal of dredged materials? What are the risks involved? Nowhere are the pressures for answers more keenly felt than in New England, a region of historic dependence upon its coastal zone resources and whose lifeblood is delivered in ocean borne vessels.

It seems unrealistic to consider placing on land the millions of cubic yards of organic muds removed annually in the maintenance dredging of our megalopolitan harbors. The practice in these areas, where possible, has been to dispose of the material at sea because of the lower cost and influences of population, congestion, urban development, and public concern over local nuisance and harbor pollution.

For every cubic yard of mud placed on shore six yards of mud-laden water must be discharged from the disposal area. This usually means discharging turbid water back into the harbor despite efforts to settle the solids in stilling ponds. Bucket dredging the spoil to land placement areas involves a mechanical relocation, with ultimate discharge of the material resulting in transferring a potential marine pollution problem into a land one. It seems inevitable that the Nation is going to increase the volume of sea disposal of dredged materials. Environmental improvement will increasingly come about through understanding the effects of such disposal and learning how to manage it.

The authors are staff members of the New England Division, Corps of Engineers.

Alternatives to ocean disposal in the New England coastal region practically do not exist. Maintenance dredging materials, except for those removed from sand shoals at channel entrance bars, consist almost entirely of organic silts including varying amounts and types of pollutants. Anticipating the need for an extensive sampling and testing program, the New England Division of the Corps of Engineers initiated the collection of physical, chemical and biological data on all dredging projects as a routine procedure in the summer of 1970. Major reliance fell upon the capabilities of the marine laboratories of the University of Connecticut, the Maine Sea and Shore Fisheries and private testing services.

An offshore program had been initiated in embryonic form in 1967 under a monitoring contract funded by the Corps' New England Division. It was administered through the Bureau of Sport Fisheries and Wildlife, Department of the Interior, in conjunction with the University of Rhode Island. Under the direction of Dr. Saul Saila, a study was made on the effects of ocean disposal of dredged material from Providence River and Harbor into a deep water area in Rhode Island Sound.

The initial work, Phase I, (1967-68), was designed to provide limited predisposal information on the proposed disposal site, and some short term tolerance studies of locally important marine organisms. This work was also designed for a preliminary evaluation of the effects of disposal of dredged materials on the disposal site and surrounding area after approximately two million cubic yards of sediment had been dumped.

Phase II (1970-71) covered conditions up to when approximately eight million cubic yards had been dumped. Phase II was designed to bring physical observations up-to-date and to reach general conclusions about the response of benthic invertebrates to environmental disturbances.

Phase III to be carried on into November of 1972, with Sheldon Pratt as principal investigator, will extend and bring further up-to-date the observations on the colonization of dredged material by benthic invertebrates, and will compare turbidity conditions over the disposal site with those conditions in surrounding waters and under different sea states. Significant changes in topography, if they occur, will be reported on and evaluated as will the changing character of the bottom surface.

During the summer and fall of 1970, the University of Maine marine laboratory, under the direction of Dr. David Dean, demonstrated that valuable data could also be derived from short-term studies. Laboratory personnel evaluated the impact of the dredging and dumping operations of what generally were believed to be highly polluted materials from Belfast Harbor, Maine, which were dumped in deep water south of Isle au Haut in the Gulf of Maine.

In an effort to establish guidelines for the protection of water quality standards, the Environmental Protection Agency (EPA), in February of 1971, issued criteria to its regional representatives to be used in determining acceptability of sediments for ocean disposal. Within a short time, it became clear that the guidelines were not applicable in all cases since natural background conditions often exceeded the established ceiling levels for concentrations of metals and organics. However, this gave pause to all concerned agencies to consider the problem in greater depth, and to search anew for yardsticks by which to measure acceptability.

At the time of the issuance of EPA criteria, Corps of Engineers research had not revealed serious environmental damage in the instances studied. What was revealed, both in our work and in public pronouncements being made, was a general condition of utter ignorance concerning the effects of ocean disposal. At this time the Corps contacted Dr. Bostwick Ketchum, associate director of Woods Hole Oceanographic Institution, and asked him if he would host a meeting of the best available minds in the area to air the subject. The response was gratifying, and on February 23, 1971, an *Ocean Disposal Conference* was held at the Marine Biological Laboratory in Woods Hole, Massachusetts, cosponsored by the Woods Hole Oceanographic Institution and the New England Division.

The oceanographers, after the authors discussed the general problem of disposing of dredged material, divided into three groups to discuss biological effects, characteristics of dredged material and criteria for disposal areas. When the whole group reconvened, each *rapporteur* summarized the consensus of his group. Discussion followed each report. The report of the panel on biological effects was delivered by Dr. Peter Wiebe, and the panel on dredgings by Dr. George R. Harvey, both of Woods Hole Oceanographic Institution; and the report on disposal area criteria was delivered by Dr. John Schlee of the U. S. Geological Survey. The sixteen other conferees included oceanographers from Woods Hole, the University of Connecticut, the University of Rhode Island, the University of Maine, the National Marine Fisheries Service, and Corps' Coastal Engineering Research Center.

Corps vessel Manamet, rigged for environmental studies, moves offshore to collect ocean bottom samples.

One of the most interesting aspects of the Woods Hole conference was that none of the participants objected to ocean disposal *per se* or expressed the idea that it should cease or be phased out. However, areas of importance were identified that should be considered off-limits for disposal for economic, ecological or aesthetic reasons. It was stressed that deep sea disposal (beyond the Continental Shelf) should be prohibited until much more is known about its effects, because the area below the lower limits of the permanent thermocline (about 200 meters) is an environment that has very narrow physical and chemical limits. The consequences of adding organically rich material beyond these limits are almost completely untouched in research.

One theory holds that with increasing ocean depth and distance from shore, the fauna is less capable of coping with environmental changes. A further recommendation was that areas not presently designated for disposal be considered off-limits as well.

The advisability of moving disposal areas, in New York Bight for instance, from time to time to study how they recover was explored at length. This raised the question: should the disposal be shifted to other areas previously dumped in? Objections were forthcoming that such areas do not have sufficient capacity and, considering the various types of materials involved, the resulting situation would be confused.

It was advanced that there are plenty of areas other than the deep sea that could be used, and that they should have priority. An intriguing thought brought up was that, since animals in shallow waters are usually more tolerant to a variety of environmental parameters, perhaps shallow areas might be more suitable than deeper areas for receiving certain kinds of spoil. This was a cautiously advanced speculation inasmuch as many shallow areas are the most productive in terms of fish nursing areas and fishing grounds. Obviously, these unanswered questions pointed to the lack of available knowledge and the need for more study.

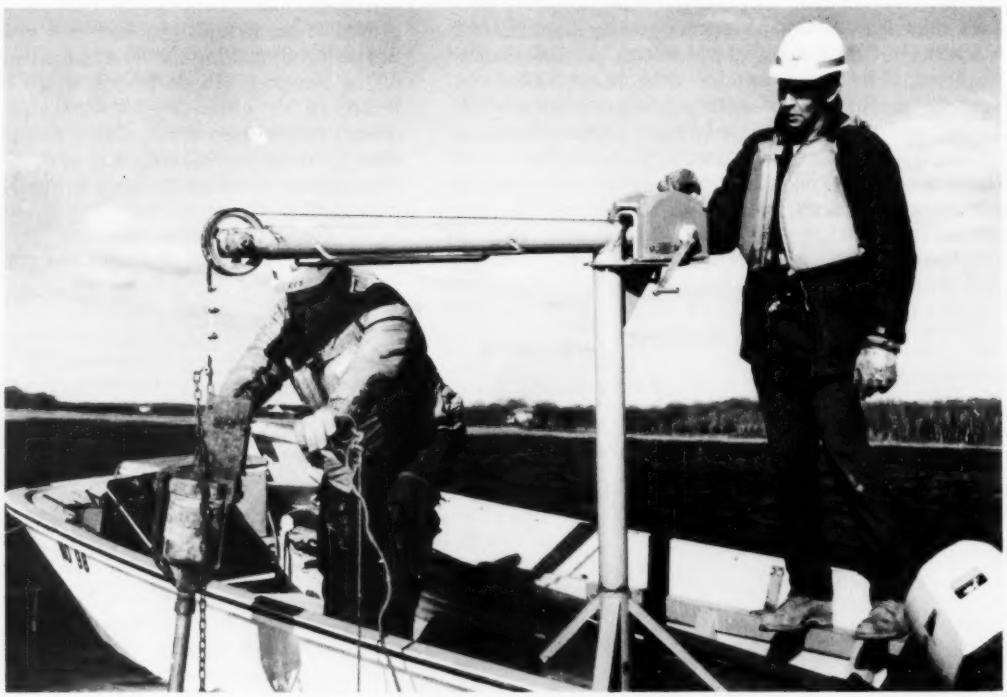
The problems of heavy metals proved to be especially complex. Considerable clarification is required regarding what constitutes heavy metals background (natural concentrations) in marine soils and the availability of metals (in mineral molecules) to the food chain. This involves such considerations as cation exchange and the relative strengths of binding constants. It appears, however, there is some evidence that a generalized mineral or metals background can be determined to a considerable extent, at least for the Atlantic Continental Shelf. The discussion brought out that there is a problem of interpretation, nonetheless, of being certain that what is measured is something of ecological importance rather than something contained inside of a rock that will not affect anything.

It was agreed that materials to be dredged should be analyzed for metals and organic compounds and that dangerous levels should be established as *"x times"* the background of the receiving area. Analyses should include local industrial wastes — phenols (paper wastes), anilines (dyes, explosives), chlorinated hydrocarbons (polyvinyl-chloride) —— and agricultural wastes (pesticides and herbicides). Further, it was recommended that levels be established at which sediments would be better left alone, since dredging will stir up and redissolve many toxic organic substances at both the dredge and disposal sites.

Other important parameters were pathogens, oxygen demand and — most important — the physical behavior of the sediment when dropped in sea water. The latter proved to be a major problem area in itself. It involved discussion comparing the wave climate at the disposal site off of Newport, Rhode Island, which the University of Rhode Island is studying for the Corps, with wave conditions off the New Jersey coast, and invoked problems relating to the internal velocities of deep water waves as a consequence of recent findings in the North Sea.

University of Rhode Island scientists, under a Corps contract, pull up sediment and biota for study.

Biologists process grab samples from the Newport dumping ground.



This miniature Kullenberg harbor bottom sampling device was developed for use in predredging investigations.

Marine biologist runs tests on ocean bottom samples.

Toxic wastes and highly organic wastes pose contrasting situations. The general premise of the Woods Hole conference was that toxic wastes should be *retained* (by proper disposal site selection) and that organic material should be *dispersed;* but that disposal should not be allowed in regions which cannot recover from the applied stresses. Thus, organic material should not be put into areas already subjected to oxygen depletion and a high nutrient content.

To achieve the *maximum retention* of spoil, the bottom area selected should be one where fine-grained sediment currently is accumulating. This requires geological examination in terms of physiography, fossils and carbon-14 determinations, for example, to distinguish active deposits from relict deposits and to establish the rate of deposition. Dumped material also should be monitored for long periods to test the selection of a particular site. *Maximum dispersal* areas, on the other hand, would display little evidence of material accumulation and would have coarse-grained, cobbly and sandy bottoms further characterized by the presence of encrusting organisms, bryozoa and sponges.

It was agreed that nearshore currents were fairly well known, but offshore conditions much less so. This consensus verified that more knowledge is required of the velocity of tidal currents through a lunar cycle, the velocities of bottom currents under storm conditions, and the residual drift patterns resulting from their interplay.

A *dispersal site* was regarded by some participants as a high energy area frequently characterized by a coarse-grained bottom, and a *retention site* as a low energy area with a fine-grained bottom. This near, apparent taxonomic solution, with its polarized criteria, experienced problems in two primary areas. One consideration was that cohesive fine-grained sediments tend to go down as a mass rather than disperse readily. The other was that toxic substances occur in highly organic substances.

There was no ready solution for these problems although suggestions included the possible addition of chemical additives to increase cohesion — and thereby further minimize dispersal — burial of toxic waste with clean material, and skimming off toxic surface materials at the dredge site for separate disposal on land. It was also considered that to match sediment types would enhance the survival of biological communities subjected to the disposal of toxic material but that a dispersal site would minimize benthic population burial, have the potential for maximizing rates of repopulation, and maximize rates of the recycling of organic material. The latter appeared to be the more favorable condition — at least for smaller quantities of organic, nontoxic spoil — and it was suggested that water could be added to the dredged material to maximize dispersion.

We believe that an intensive program of study and research represents the laying of a cornerstone for an important aspect of coastal zone management. Whatever criteria are adopted for disposal area selection and use necessarily will involve trade-offs against fishing, mining, and recreation, but the opportunity to benefit certain bottom areas or cover undesirable sediments should not be overlooked. The basic criteria, to be used in the light of the degree of dispersal or containment desired, are — physiography and sea floor sediment of a particular area, current regime, nature of the dredged material, and the biological community of the area. This means the Continental Shelf will have to be mapped and classified according to these criteria, and for the occurrence of fish, fish nursing areas, feeding grounds, productivity level, recreational requirements and health needs (hazards owing to feedback into human populations).

To us, as managers of ocean disposal, the need for greater knowledge of its consequences is implicit. The pervasive influence of this activity and the span of the information gap dictate that all possible resources available must be brought to bear on these problems in coordinated programs of research and experimentation. Within our limited means to date a good beginning has been made and a framework for further action laid down. ■

An article in Water Spectrum prompted this response. . .

THE IZAAK WALTON LEAGUE OF AMERICA
INCORPORATED

October 26, 1971

Editor, Water Spectrum
Office, Chief of Engineers
Department of the Army
Washington, D. C. 20314

Dear Editor:

We have just reviewed Harry Cook's article in the Fall 1971 issue of Water Spectrum, "Nourishing Public Participation." His reference to Izaak Walton League input at the June 8-10 Des Moines meeting is appreciated. I am certain, however, that in making it, Mr. Cook did not mean to imply that an unidentified suggestion for "turning the entire planning procedure over to citizens groups, as has been proposed" can in anyway be attributed to the League. Regrettably, this is the impression given since we were mentioned in the same breathe, or rather, paragraph as that suggestion.

The thought occurred to us that perhaps it would be fruitful and fair to provide our representative at the Conference, Ted Pankowski, an opportunity to comment on his suggestion in our behalf more fully. I am certain he would on request be pleased to do an article for the next issue of Water Spectrum elaborating on the theme that Federal funds be channeled to private organizations for the purpose of stimulating public response in water resource programs. Your advice would be appreciated.

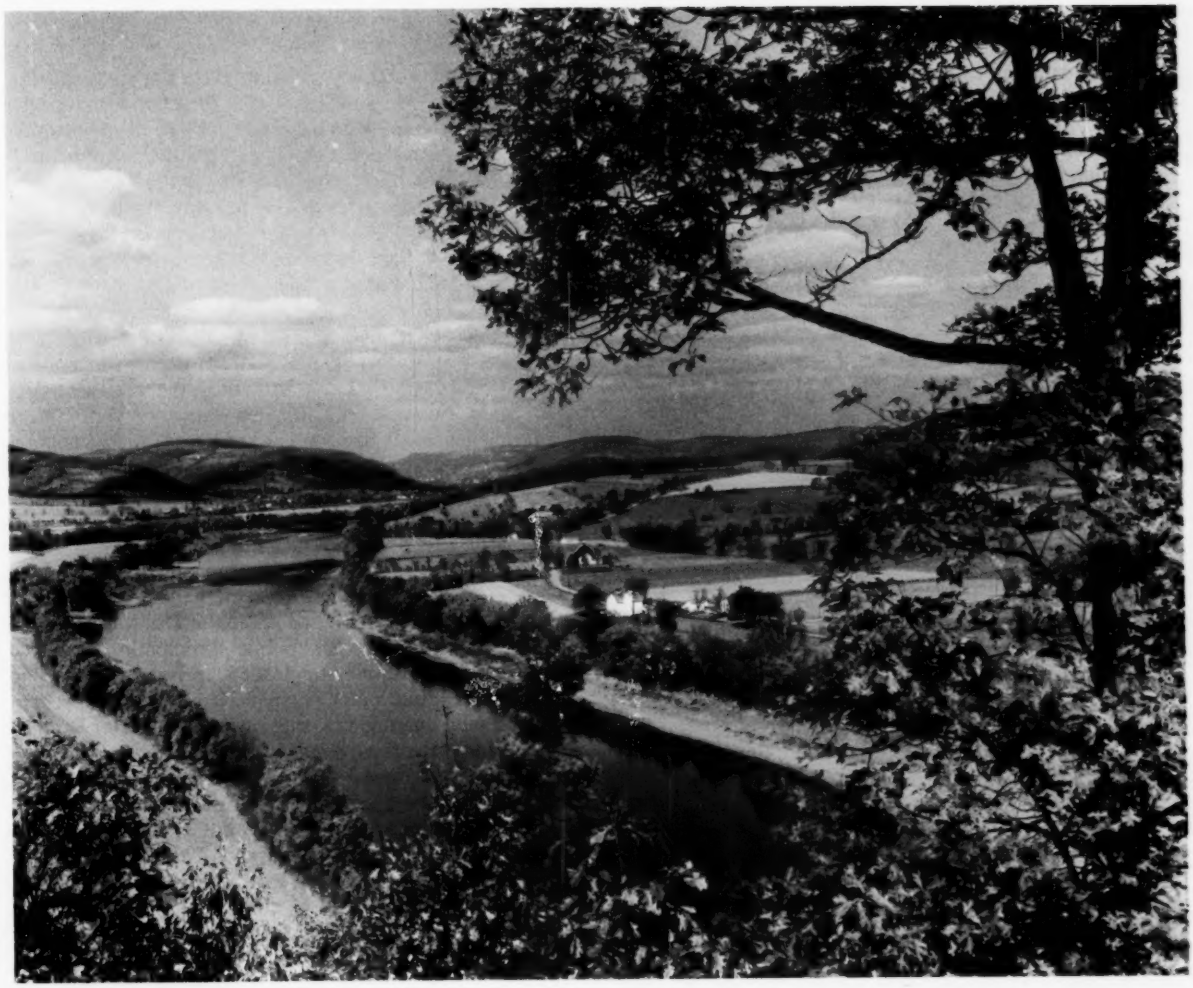
Sincerely,

Raymond C. Hubley, Jr.

Raymond C. Hubley, Jr.
Executive Director

We welcomed the letter's suggestion as well as the opportunity to see what process Mr. Pankowski would prescribe for more meaningful public participation in water resource programs. His prescription is —

Scenes such as this are reminders that rivers are a part of the quality of living; that every person has an inherent interest in their uses and, therefore, as an individual or through citizen groups, every person has an inherent right to participate in water use planning.



LET'S REVITALIZE WATER PLANNING

By Ted Pankowski, Director
Environmental Affairs
Izaak Walton League of America

The popular rock group "Rare Earth" has the kids dancing to a new song.

"Hey, Big Brother, as soon as you arrive
You better get in touch with the people
And get them on your side, Big Brother,
Gotta keep them satisfied."

The "Rare Earth" group does mean *government* just as V.O. Key began his textbook, *Public Opinion and American Democracy,* 10 years ago with a classic political admonition. "Governments," he wrote, "must concern themselves with the opinions of their citizens if only to provide the basis for repression of dissatisfaction."

Somewhere between the droll and the cynic lies the challenge for water resource planners today. In fact, they are on trial to find this equilibrium, and the judge and jury is the environment itself; and the people, now and future generations, who depend on the environment, must worry about it and be prepared to defend it.

Who Is the Public?

Until the forces leading up to Earth Day 1970 pushed "environment" to the top of the Gallup Poll, water resource planners had a fairly easy time keeping track of their constituents. They were, for the most part:

- the engineers who took projects off the drawing boards and planted them on or under the ground;
- a rural and localized citizenry that directly benefited, were displaced or suffered from public works programs. (TVA is the grand-daddy of all since it transformed an entire region);
- easily identified users, including recreationists, and their friends in government; and
- a dozen or so leaders of the major conservation groups who, for more than two decades, by sufferance sat in the offices of the Secretaries of the Interior holding high the environmental torch that now lights the entire developed world.

Today more people than ever seem to care about water resources and, one way or the other, are involved. Yet their interests and affiliations don't necessarily fit the old pigeonholes. Most live in cities and suburbs far removed physically and psychologically from water resource projects. While America, and its water needs, moved into megalopolis, water planners seemed content to stay behind to deal with the "old" constituencies. As a result, the planner today has been asking *who* is the public he is supposed to involve and serve.

The question is not irrelevant, but it may not be the critical one! The reason is that with shifts in population came shifts in understanding. The public — at least the concerned and involved one — knows that we are not only "users" but part of a web of life. Disturb one part and for better or worse, the whole must change. In appealing to the public for support, the planner can no longer rely on the New Deal assumption that our water resources can always be converted into concrete benefits — whether economic or environmental. He must share in Aldo Leopold's caution:

"We are remodeling the Alhambra with a steam shovel and we are proud of our yardage. We shall hardly relinquish the shovel, which after all has many good points, but we are in need of gentler and more objective criteria for its successful use."

The admonition of Alhambra is being recognized elsewhere. In Congress, especially, the need for relevancy in mapping out sound courses of public action, using the right tools, has been coined as "public participation." Harry N. Cook, Executive Vice President of the National Waterways Conference cites the need (in *Water Spectrum,* Fall 1971) for "Nourishing Public Participation." The law requires it. The National Environmental Policy Act, in particular, imposes a duty on *all* to articulate the full range of possible alternatives and their environmental consequences. It cannot be done — the act cannot be satisfied — until the planning process is opened up to every possible timely input. Moreover, the trend set by the act is up. Scarcely any new legislation — from coastal zone management to power plant siting — is without its requirements for public hearings, advisory boards, judicial review by citizens and the like. The total beneficiary of water resource planning and programs — this homogeneous "public" — has finally been recognized as an "official partner" in the governmental process.

In two recent seminars (one at Cincinnati, Ohio in February and at a follow-up session at Des Moines, Iowa in June 1971), how to get "public participation" involved hundreds of governmental leaders, private citizens and Federal and State water planners. It was an unprecedented and long overdue first step by the U.S. Water Resources Council, the focal agency for water and related land planning in the United States. The sessions concluded that the "environmental constituency" had been notably absent in the planning process. Moreover, they triggered a series of responses from Washington-based national conservation groups, indicating that a dramatic change may be in the offing.

In 1965 conservationists supported the Federal Water Resources Planning Act which created the Water Resources Council at the Federal level and River Basin Commissions. It was an attempt to bring together water resource planning efforts scattered and fragmented throughout many agencies of government for the solution of emerging environmental problems. But in the seven years since the Planning Act, conservationists all but ignored what they helped to create. As a result, environmental thinking has not been cranked in at that critical juncture between enactment of legislation and the implementation of programs on the ground. In frustration, conservationists have been using the National Environmental Policy Act — and rightfully so — in taking their case to the courts as a last resort. Most of the issues raised under this act — from the Calvert Cliffs case to Gillham

Izaak Walton League of America

Disturb one white birch, for better or worse, and the whole changes. Today more people than ever before are concerned about such things, yet most are far removed physically from environmental changes that accompany some uses of water.

Dam on Arkansas' Cossatot River — have been procedural, cases where governmental agencies had failed to report and comment on the full range of alternatives and their environmental consequences as the law requires. But the gap itself — between legislation and implementation — can only be met in most instances by a decent planning effort. The question for our day, then, is whether the primary value of the act will continue to be a vehicle for getting into court or a *Magna Carta* for keeping out. It is a question that must be answered by conservationist and planner alike.

Bees and Honey Bears

Recently in Washington, D. C., eight major conservation groups arranged for a briefing on the Water Resources Council's proposed new principles and standards for evaluating water and related land uses. These eight were the Citizens Committee on Natural Resources, Friends of the Earth, the Izaak Walton League, National Wildlife Federation, Natural Resources Defense Council, the Sierra Club, Wilderness Society and the Wildlife Management Institute. Representatives from a dozen other public interest groups also attended. Chairman Thomas Barlow of the Natural Resources Defense Council opened the meeting with a certain "skeptical optimism." This attitude may be shared eventually by an increasing number of policy makers, such as the Council on Environmental Quality and members of Congress, who, along with private citizens, find little value in the tomes of so-called "comprehensive" planning reports when answering the gut questions and demands of their own congressional constituencies.

"We are the bees," Barlow said, "and they — the water resource agencies and planners — are the honey bears. We've driven them away from a few hives (the Cross-Florida Barge Canal, for example) but they are still on the prowl. We have not gotten to the root of what we consider to be their unconscionable predator instincts. Perhaps to reorient — to truly reform — these agencies we have to learn their language, play their game... ."

The comment raises fundamental questions. Is it the public or government that needs "nourishing?" And are advisory boards and public hearings enough of a bandage on a water resource planning system that may be bleeding the environment to death because of its inability or unwillingness to play its necessary role in the increasing frays between contending development-environmental forces?

Dr. J. William Wenrich, Vice President for Administrative Affairs, Ferris State College, Michigan, suggested the answer at the Des Moines meeting. "Public participation," he said, "is a *process*, not project agreement seeking." Urging that planning must provide adequate access to information and give people a chance to respond to it, Wenrich said that it was the opportunity that was important. "If they choose not to respond, that's their decision and not yours."

What is truly needed to revitalize water planning is not so much an institutionalized form of soapbox from which citizens can vent their frustrations. Rather, we need a meaningful and understandable *process* to which all interested individuals have access and from which citizens and policy makers alike can find solid answers to deep concerns, whether environmental or not. The call for "public participation" is essentially a call for "good" government. The water resource planner who underestimates this key to citizen action and involvement does so at the peril of his own unique contribution to the human environment.

Self-Fulfilling Prophecies

The Nixon administration, just as many past administrations have done, has recommended that Federal water resource agencies, such as the Corps of Engineers and the Bureau of Reclamation, be consolidated into a Department of Natural Resources. The idea is to bring planning and construction capabilities together under one roof. Some have argued, mostly unsuccessfully, that such a department would be a superagency and that it would be preferable to have the planning and management functions of government in different agencies. Others, particularly in Congress, with some — but not decisive — environmental support, believe an effective compromise would be to create an independent planning capability with close agency ties. The proposed National Land Use Policy legislation, for example, originally called for an expanded U.S. Land and Water Resources Council patterned after the existing Water Resources Council.

Governmental structures are important, particularly since they affect congressional-administrative arrangements. But politics aside, whatever finally emerges, citizens will need some new rules of the game.

Fundamentally, *we need a new basis for planning.* Existing efforts are based on economic and population trends projected into the future. Take the past conditions within a given geographic area — generally an entire region or river basin — crank in a series of modifiers, such as average birth rates and indices of inflation, multiply and/or divide and you have a simplified version of the so-called OBERS* projection. Water resource planners consider the projections to be synonymous with public goals such as so much water for drinking purposes, so many new navigation channels for industry, an X amount of recreation sites. Planning decisions are then boiled down to when, where and how a project can be built to meet these "needs." What about pollution abatement and control, wild and scenic river designations, the preservation of ecological and historic sites, open

* Office of Business Economic Research Standards

Izaak Walton League of America

As spring thaws inundate floodplains, will these grade school students understand why? Will they be part of a more knowledgeable public that engages in tomorrow's water resource planning?

Izaak Walton League of America

Before launching projects such as this, the Izaak Walton League asks planners to consider Aldo Leopold's caution: "We are remodeling Alhambra with a steam shovel and we are proud of our yardage. We shall hardly relinquish the shovel, which after all has many good points, but we are in need of gentler and more objective criteria for its use."

spaces and housing, flood plain and estuarine protection, agricultural locations and the amenities?

How does planning today account for opportunities for a "quality" life as well as protect a finite resource base on which even the Nation's economy must ultimately depend?

Environmentalists view the OBERS system as nothing more than a series of self-fulfilling prophecies. When money — particularly Federal money — comes in, can growth, whether desirable or not, be far behind?

One Federal-State planning agency is unique in its unprecedented effort to turn the situation around. The Lands Committee of the Pacific Nortwest River Basin Commission has prepared a report *Ecology and the Economy*. The report lays out a new framework for resource planning and begins with the fundamental environmental question: "What combinations of population and economic activity would be best for the Pacific Northwest in the long run?"

The Committee is convinced that land and water planning must be integrated and based on the carrying capacity of the region to satisfy certain economic and environmental needs. Planning then becomes a positive force for desirable change rather than a reaction to uncontrolled growth. It would begin with a sound resource inventory and have a continuing mechanism for the expression of social preferences. Can such a system work? The Committee has been given nearly a year to solicit professional and public comment on its work. If successful, *Ecology and the Economy* may pioneer the kind of planning effort environmentalists can live and work with.

Citizens Need Help Too

Funds should be made available to public interest groups to ensure their participation in the planning process.

Try to put a dam in his back yard or channelize his favorite trout stream and you are likely to end up with a "concerned citizen." Give him unconvincing reasons for it and you have an angry one. The old axiom to be contended with by government and conservationist alike is that "I'm all for parks, and so forth, but not in my backyard."

What's new? The citizen cannot be dismissed as a "crank" because of his concern, and it is not only his own motivation that distinguishes him from the "average" guy but how convincing the public necessity is. Today this holds true for economic as well as environmental claims.

The value of the organized citizen group is that it serves as a relatively independent sounding board against which

to gauge the merits of public action. Even those with specialized interests (the Izaak Walton League is not in business for the same reasons as the Lower Mississippi Valley Flood Control Association) can provide the planner and the policy maker with a certain continuity of opinion. The citizen group is also free to break new ground. With exposure and a continuing dialogue, the planner should be able to distinguish one phenomenon from the other.

The limiting factor is how well the citizen group can function. Americans are inveterate organizers. The list of Washington-based interest groups, for example, takes up pages and pages of the phone book — everything from AAA to the Zoological Society. Within this spectrum the environmentalist must shift as best he can, to attract not only attention but hard-to-come-by dollars. Most public interest groups are short-staffed, under-funded and with more interests and demands on them than are manageable. Even those organizations having a sound and regular base of financial and political support from State and local affiliates must pay careful attention to their own internal priorities. In the past, long range water resource planning has not been among them. As Ian McHarg asks in his pioneer work *Design With Nature:* "Who can plan for tomorrow when survival is today?"

Citizens simply cannot afford to have what attempts they do make ignored. The Conservation Council of Virginia, for instance, has been asking for a sound land and water use planning effort at the State level as a recognized key to a quality environment. Consisting of representatives of more than 40 public interest groups — from the Farm Bureau Federation to the Wilderness Society — the Council represents a sound consensus of environmental thinking in the entire region. Yet like most citizen groups, the Council can ill afford its concern and must rely on the voluntary work and contributions from its participants and supporters. If the Council's capability is makeshift for what needs to be a sustained and comprehensive effort, so must be the result. Unless the situation is improved — with planning grants and other financial help — the citizen consensus on land and water planning may be lost to Virginia. Should that happen, the inevitable imperative will be to use what resources the Council can pull together to deal with project after project on an *ad hoc* basis. Generally, it means the courts.

In the recent debate over the new Water Pollution Act amendments in Congress, the League of Women Voters applauded a requirement in the bill for full "public participation." The League's statement, however, expressed skepticism "of the practical possibility of valuable citizen input when there are no funds authorized (in the bill) for citizen education or for research by public interest groups." A self-serving observation? Hardly!

Several years ago, the author was sent to New England to look at a growing controversy over a pump-storage project proposed by Northeast Utilities. Most of the local opposition statements, including the one prepared in behalf of the Izaak Walton League, voiced adamant stands against undertaking any such project. By contrast, the efforts of the League of Women Voters and other groups, who had at least enough funding to finance a more objective look, showed that several options had been ignored and obscured by those practicing the heated rhetoric of the day. Respected colleagues, such as the League of Women Voters and their allies, called for discussion of possible alternatives which would not involve the disastrous effect first expounded by the opposition groups. Had the former opposition's research efforts been better funded, perhaps through governmental assistance, the rhetoric might have been exposed for what it was that much sooner.

Cutting Out the Shortcuts

What's the old saying: "The best laid plans of mice and men. . ."? The critical weakness of most planning efforts is that there are just too many loopholes. Within government especially, land and water resource planning tend to be separated depending on the missions of the various planning agencies. Little wonder that as long as such an attitude prevails, we have an increasing number of planing proposals all unrelated to each other — one for coastal zone management, one for the location of power plants, one for the siting of pollution abatement facilities, one for fish and wildlife purposes and on and on.

Moreover, even many water-oriented programs and projects are exempt from what minimal planning requirements are on the books. A good example is the small watershed program of Agriculture Department's Soil Conservation Service. As a consequence, a full range of alternative actions cannot be considered for the same river or plot of ground. Environmentalists and developers, particularly, have been playing their own little games in separate ballfields. The one hopeful note is that this may be changed through the Water Resources Council's new formula of evaluation procedures.

Add to this formula an administrative and legislative process that still responds primarily to local sponsors of public works, rather than to a comprehensive planning effort, and you have all the ingredients for irrelevancy. Admittedly, much of the solution lies with Congress; but if the planner sees his work becoming of less and less value to fewer and fewer people, he must certainly ask himself *why*.

But even if these and other fundamental reforms are made, will citizens then respond? It's difficult to say. Citizens do not want to run government. Most find it tedious business or cannot afford a mimeograph machine and a mailing list. They are willing, however, to assert their basic responsibilities of citizenship given half a chance.

In December 1971, for example, the citizens of the Northern Environmental Council (a council of

Water resource planners and planning are on trial and the judge and jury is the environment itself.

Izaak Walton League of America

organizations in the upper portions of Michigan, Wisconsin, Minnesota and North Dakota) called for a reorientation of planning by Basin Commissions for the Great Lakes and the Upper Mississippi and Souris-Red-Rainy Rivers. Their observation was that the Commisssions should change their objectives "from economic development and agency project promotion" to rehabilitation of damaged natural resources with a view "toward fitting man's needs into the carrying capacity of the ecosystem."

A tall order, but with the help of the Council and of others with new ideas, it could be done. What if such essential changes are not forthcoming? Then, we have to rely on the good work of people like Jerry C.

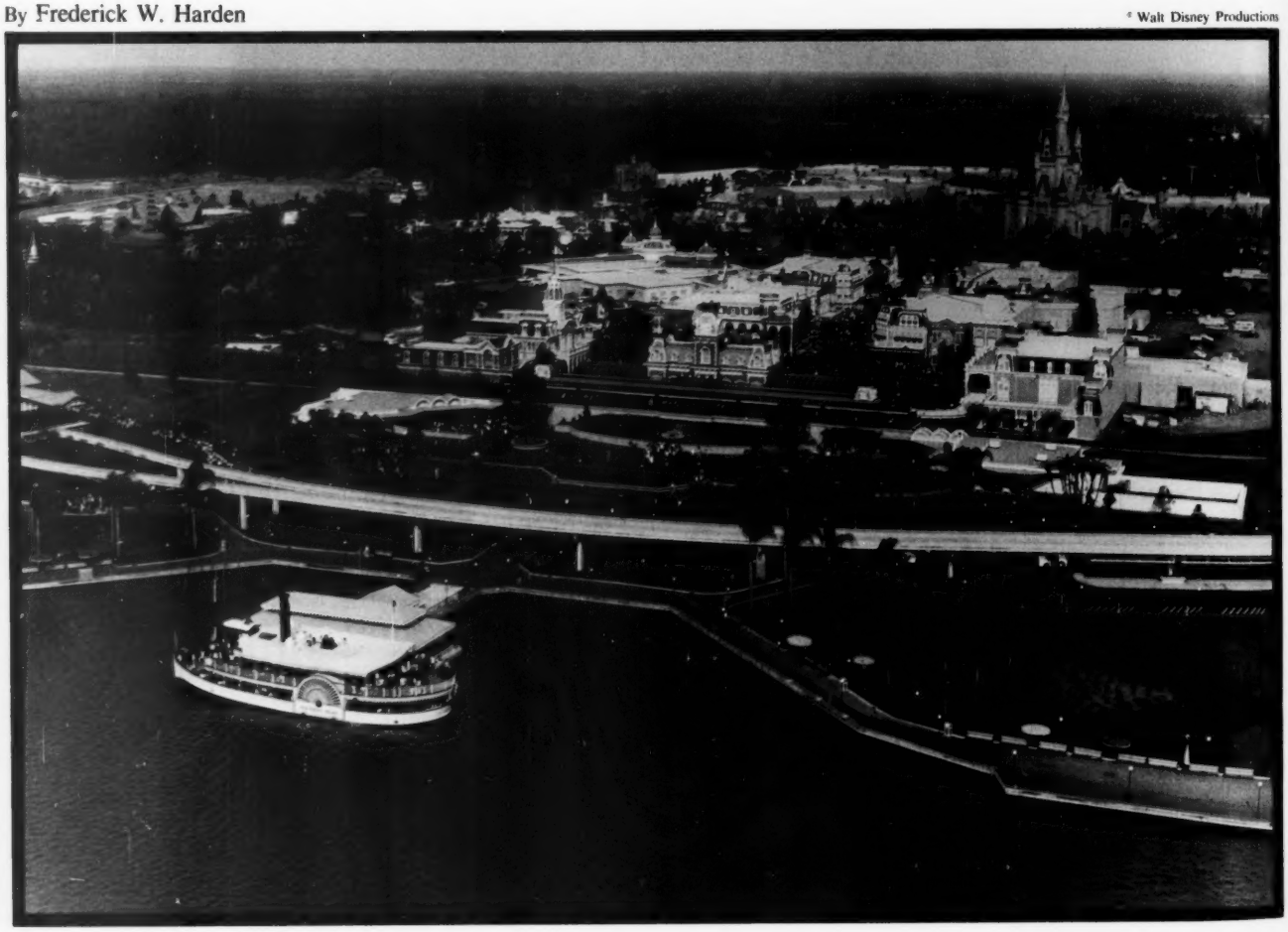
Jerry C. is a mortician, but most folks in mid-Appalachia know him also as "the black water" man. Black water is the drainage from coal mines and West Virginia streams feel it every time it rains. The law requires coal operators to install coffer dams to store it, but when they fill up, some pull the plugs in the middle of the night. Jerry is usually waiting in the stream with sample bottles that end up on the desks of water pollution control officials. Some people love clear streams that much.

Two years ago, on the assumption that it had touched all bases, the Federal Power Commission was asked to license the Blue Ridge hydroelectric project on the New River upstream from Jerry C's home. When he learned of it, Jerry came to Washington to ask the Commission what the project's effects would be on downstream waters. Despite what were alleged to be years of preparation for the project, an answer was not forthcoming. Jerry's intervention for the West Virginia Izaak Walton League was totally predictable. Moreover, it triggered a series of other interventions, by citizens and State governments, who had many other questions as well.

Blue Ridge has been delayed, if not stopped altogether, in what has become one of the most protracted struggles within government. Would a decent and comprehensive planning effort for the New River have made a difference? That's even more difficult to say. But Jerry C. and citizens like him have been burying a lot more than people these days. ■

Walt Disney World and The Environment: AN ECOLOGICAL CHALLENGE in Central Florida

By Frederick W. Harden



© Walt Disney Productions

"Build the finest family-oriented vacation complex in the world over 27,400 acres of pine woods and cypress swamps with a priority of protection to the ecosystem of central Florida." That was the goal set before planners, engineers and construction forces preparing the $400 million Walt Disney World Vacation Kingdom in the heart of central Florida.

Before the first spade of dirt was turned, Disney management made a total commitment to the maximum protection of the environment.

Throughout the years, the projects of the Walt Disney organization have always exemplified the company's commitment to the maintenance and wise use of our American resources. This dedication is expressed through the company's recreational projects, television shows and motion pictures, especially through an extensive series of "True Life" adventures and other films which entertainingly inform the public about our wildlife and natural heritage. Such dedication has brought Walt Disney more than 35 major awards in the field of conservation.

Throughout the more than 40 years that Walt Disney directed the company he founded, he instilled in his organization a substantial curiosity about the world around us — particularly, a desire to keep abreast of the evolving technologies which could be applied to the company's diversified entertainment projects.

Early in the 1960's, Walt Disney realized the need for new solutions to the problems of our cities. His search led to the concept of EPCOT, an Experimental Prototype Community of Tomorrow, which will always be introducing, testing and demonstrating the new ideas and new technologies which are now emerging from the creative centers of American industry.

Planned for construction during the second phase of the company's Walt Disney World project near Orlando, Florida, this community will provide an opportunity for all American industry to work together to successfully solve the problems of our urban environments.

When Walt Disney began quietly to assemble a 27,400-acre package of land in Florida as the future site for an entirely new destination vacation resort and, ultimately, for EPCOT as well, his objective was to master plan the entire 43 square miles so as to provide a balanced use of land with permanent protection of its natural beauty. and wildlife, while developing recreational and other facilities to serve the general public in a controlled environment. His organization accepted this challenge and has applied the highest standards of environmental control to each stage of planning and development.

The author is an Entomologist and Conservationist at Walt Disney World, Orlando, Florida.

Beginning in 1965, prior to the announcement that Walt Disney Productions had purchased its Florida property, preliminary ecological surveys were conducted and recommendations were made as to an appropriate program of water conservation and control. Subsequently, the Reedy Creek Improvement District, a public authority empowered to carry out water control programs and provide utilities and other services for the Disney property, was established by act of the Florida Legislature. The Improvement District then implemented a court-approved water control plan, which provided a permanent means of controlling and maintaining the water table throughout the property, thereby assuring the best utilization of land and the continuing prosperity of the cypress heads, pine flatwoods, swamp forest and other plant communities in the area.

To further ensure the preservation of natural resources and the conservation of water, the Reedy Creek Improvement District in 1968 contracted with the U.S. Geological Survey, a division of the Department of Interior, for a continuing, jointly-financed study of the area's urban hydrology.

This comprehensive study of the area's water resources is providing important data on geology, topography, the ecosystem and hydrology, which will have scientific and practical transfer value to urban environments in other parts of the Nation. The joint study includes a chemical and biological sampling program.

POLLUTION CONTROL

Clearly recognizing the need for a continuing program of pollution control in conjunction with the Walt Disney World project, Disney officials, in the latter part of 1967, asked Dr. Thorndike Saville, dean emeritus, College of Engineering, New York University, and consulting water resources and coastal engineer, to establish a consulting panel to investigate and evaluate the new technologies emerging in the fields of water treatment and the disposal of liquid and solid wastes.

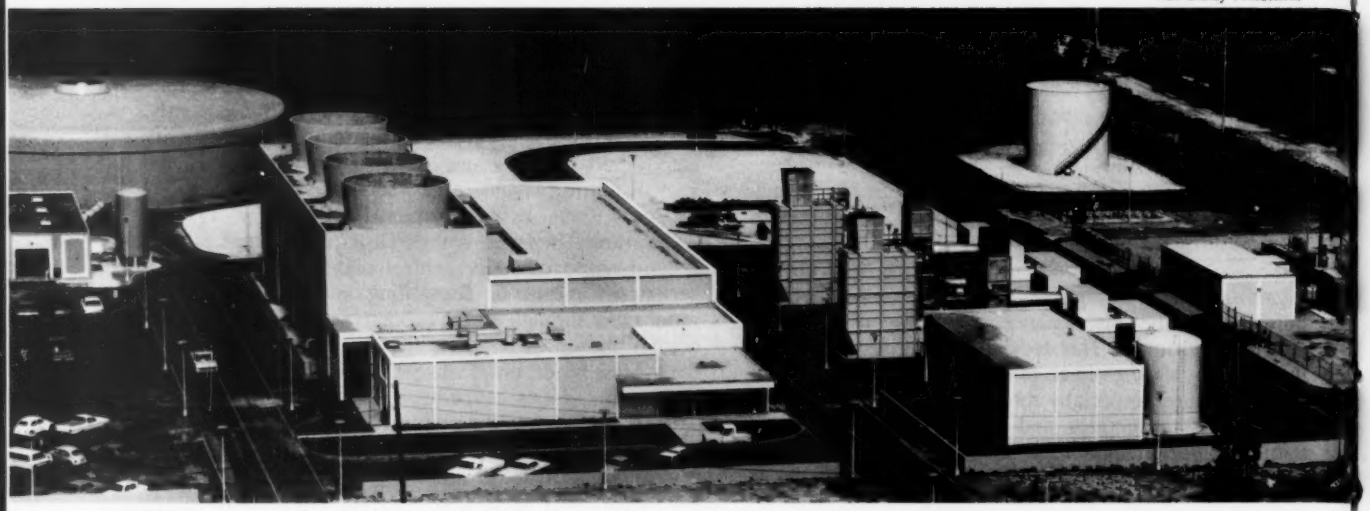
Dr. Saville, already a consultant to the Disney organization on water resources, enlisted the services of Professor P. H. McGauhey, director of the Sanitary Engineering Research Laboratory of the University of California at Berkeley; Mr. M. B. McPherson, professor of Hydraulic Engineering, University of Illinois, and director of the American Society of Civil Engineers' Combined Sewer Separation Project; and Dr. Daniel A. Okun, head of the Department of Environmental Sciences and Engineering, University of North Carolina.

These four men evaluated and were familiar with numerous research and demonstration projects then proceeding under the auspices of the U.S. Public Health Service, the former Federal Water Pollution Control Administration, and other Federal agencies, in cooperation with local governments and research institutions.

Their comprehensive report described and made recommendations on those sophisticated new treatment

The total property of Walt Disney World covers about 27,000 acres including this 200-acre manmade lagoon in the foreground.

© Walt Disney Productions



The 43-square-mile complex is serviced by this complete energy resources plant. Waste heat created by gas turbine generators recycles through the system to produce hot water, chilled water and compressed air. These in turn fulfill such needs as heating and airconditioning.

© Walt Disney Productions

Right:
A network of utility corridors under the major structures provides access to all utility services as well as routes for small vehicle delivery.

systems which were available for installation before Walt Disney World opened to the public in October, 1971.

Among the concepts recommended by the panel and adopted by the systems designers were the following:

Utilidores — A network of utility corridors (utilidores) under the major structures within the amusement theme park to house and provide easy access to all utility services (water supply, waste water and solid wastes collection and transport, electrical distribution system and small vehicle delivery and service transport);

Living Tree Farm — In November, 1971, Walt Disney World and the University of Florida announced the signing of a grant agreement whereby the University's Institute of Food and Agricultural Sciences (IFAS) will conduct research on the Walt Disney World's "Living Farm" — an experimental waste water recycling system.

The research is designed to develop an effective way of recycling municipal waste water. Crop and forest land will serve as a "living filter" to remove nutrients and return clean water to the ecosystem.

The goal of this joint research operation is to use the soil and a wide range of plants as a huge living filter system to purify the effluent. It also is designed to discover effects of the effluent on the microenvironment and the ecology of the plant communities, as well as the nutritive value and palatability of the food forage and fiber produced on the plots. The plots, totaling about 100 acres, will be planted with agronomic crops, turf, other grasses and ornamental plants. . . totaling nearly 100 varieties.

Natural drainage patterns will be used to get effluent from holding basins to "Living Farm" ditches for surface irrigation. Sprinkler guns with an area coverage of up to 3 1/2 acres each will disperse effluent on higher ground. Nutrient removal from the effluent and water movement will be closely monitored and bacterial analyses will go on continuously. The research and irrigation facility may ultimately cover 500 acres.

Waste Water Treatment — A modern waste water treatment plant was constructed, providing for tertiary treatment of waste water by the activated sludge process. Treatment removes 97 percent of the suspended solids. Presently the effluent is chlorinated and is now tem-

porarily fed into the upper reaches of the Reedy Creek Swamp. Present daily plant capacity is 3.3 million gallons, with planned expansion to 10 million gallons. Plant load last November was 1 to 1.5 million gallons per day.

A portion of the waste water is recycled through the Walt Disney World incinerator plant and is used to scrub the stack gases (emissions) thereby reducing the fly ash. The captive fly ash is then recycled back through the waste water treatment plant as flocculent to clarify the effluent.

Trash Incineration — A modern trash incineration facility with a capacity of 100 tons per day is in operation adjacent to the waste water treatment plant. As discussed previously, tertiary water is utilized in wet scrubbers and filters to reduce stack emissions to standards surpassing the requirements of the Florida Air and Water Pollution Control commission.

Automated Trash Collection — The Disney organization adopted for installation in the Magic Kingdom theme park and the Contemporary Resort Hotel the automated trash collection and removal system under license to Aerojet-General Corporation, a subsidiary of the General Tire & Rubber Co.

The system, called AVAC, uses underground pneumatic tubes to quickly, economically and hygienically remove trash from all sections of a facility and collect it for centralized disposal. Trash is merely inserted into a collection station, from where it can be automatically transferred at pre-programmed intervals for high-speed delivery to the disposal site. There, it is held in enclosed trash storage bins for incineration into inert fill material.

This installation, the first of its kind in the United States, will result in greater control over the waste disposal process, thereby minimizing risks to health and air pollution.

Water Quality — To further conserve water resources and to maintain control of the water quality in the theme park, the 450-acre Bay Lake and the 200-acre recreational Seven Seas lagoon, these areas have been separated from the normal water flow patterns of central Florida. The lake has had its basin cleaned, and adjacent land contours have been sloped away from its shores to slow down eutrophication by preventing surface water runoff into the lake. These waters are constantly monitored to maintain the highest standards for recreational use.

All "flow-through" water from the theme park attractions is put to use either to make up the evaporation loss in the lakes or to augment water levels in the canal system during the periods of low-flow.

The water control system throughout the 27,400 acres is designed to prevent overdrainage, resulting in one of the most complete and sophisticated water control plans in Florida.

The entire perimeter is diked so that all water entering or leaving the property can be regulated through water control structures. The system provides for flood control while at the same time preserving the normal water table. Flood waters are let down some 40 miles of canals through a series of self-regulating gates of French design

This is one of seventeen automatic water controlled structures on the 43-square-mile property.

Walt Disney Productions

(Neyrpic-Amil automatic control gates). Canals are constructed in soft serpentine lines rather than in straight lines to give a more natural and aesthetic appearance.

Central Energy Plant — Research into alternative methods of providing the necessary electrical power and other basic utilities for the project resulted in the design of a Central Energy Plant which provides emergency electrical energy and handles a portion of the demands for power during peak periods of operation.

Design of the energy plant has been integrated with the other needs of the project so that waste heat created by the gas turbine generators, rather than escaping into the atmosphere, is captured for use in producing high temperature hot water, chilled water, and compressed air. The high temperature hot water, in turn, fulfills demands for space heating, domestic hot water, cooking, and absorption chilling for air conditioning.

All of these services are provided by the Walt Disney World Co. to other users within the boundaries of the Reedy Creek Improvement District without drawing upon the monetary or management resources of the neighboring city and county governments of central Florida.

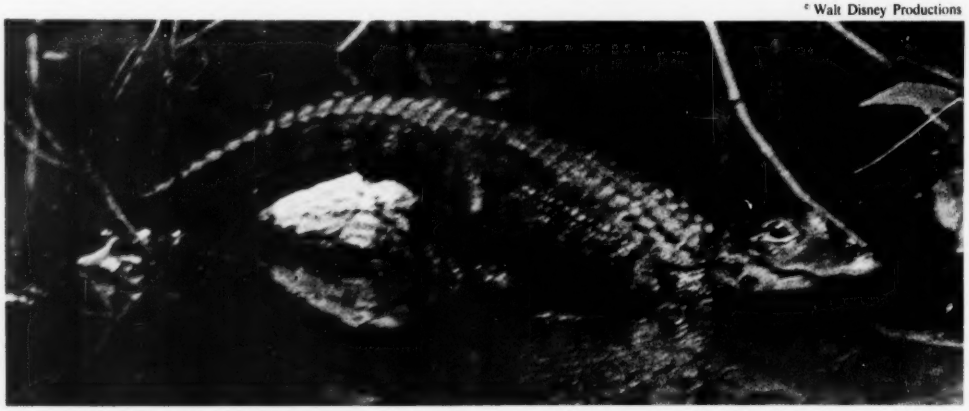
Use of Pesticides — A pest control committee has been formed which oversees the purchase and use of pesticides. Operations are under the guidance of a graduate entomologist and a pest control operator certified in all phases of pest control by the State of Florida.

The elimination or restriction of many pesticides, including chlorinated hydrocarbons such as DDT and BHC, has been completed. The pest control program uses the ultra-low-volume concepts of insecticide application based on limited treatments in only those areas of high pest density, with future plans for shifting to biological and natural control methods where possible.

Water and sediment samples are taken quarterly for the monitoring of insecticides, rodenticides and herbicides.

Pollution Prevention — Florida Department of Air and Water Pollution Control has approved a local air and water pollution prevention program developed by the Reedy Creek Improvement District. The program is staffed with a pollution control officer and assistants responsible to a pollution control board. The staff supervises the quality of waters entering and leaving the Reedy Creek Improvement District and the maintenance of the quality of the air and water in the district, in order to protect its ecosystems and maintain the quality of the environment. Water and air quality data are collected and analyzed to anticipate future pollution problems and be of benefit to the advancement of scientific knowledge in the field of environmental control.

© Walt Disney Productions



In the conservation area, a Florida alligator basks in the sun on the bank of Reedy Creek.

© Walt Disney Productions

Reedy Creek, one of the major drainage systems within the property, courses through a 7,500-acre conservation / wilderness area.

This is a shoreline of Bay Lake lined with bald cypress and lilypads. Bay Lake has been separated from the normal water flow patterns, cleaned and its shores reworked to prevent runoff into the lake, so as to slow down the eutrophication process.

© Walt Disney Productions

CONSERVATION AREA

Walt Disney Productions has designated in excess of 7,500 acres of its land in central Florida for permanent protection as a Conservation Area. This portion of the Disney property includes typical natural Florida "wet land" which is of great interest to conservationists, biologists and wildlife enthusiasts, and bird watchers, because such areas are the habitat for a wide variety of plant, animal and bird life.

The focal point for the Conservation Area, comprising approximately 5,000 acres, is the western portion of the Reedy Creek Swamp, which contains some of the most beautiful primitive areas and stands of virgin cypress in Florida. The Disney conservation plan is designed to protect and manage the area's natural beauty and wildlife, while making it accessible in future years under carefully controlled conditions for educational purposes.

The program has been developed by Walt Disney Productions with the advice and guidance of the following members of Walt Disney Productions' Conservation Advisory Committee:
Mr. Horace M. Albright, Former Director of the National Park Service, and Superintendent of Yellowstone National Park; Mr. Thomas L. Kimball, Executive Director, National Wildlife Federation; Mr. Bestor Robinson, Former President and member of the Board of Directors, the Sierra Club; Former Chairman of Secretary of Interior's Advisory Committee on Conservation; Mr. Eivind T. Scoyen, Former Superintendent of Zion, Glacier, Sequoia and Kings Canyon National Parks, and Associate Director of the National Park Service.

From the very first, Walt Disney was fascinated by the extensive areas of wilderness beauty on this Florida property. He was aware of the growing scarcity of such natural areas, and his initial planning made provision for their protection and future accessibility to the public. During six years of planning and development, the Disney organization has carried forward that goal.

Location/Description — The boundaries of the Conservation Area have been designated in the Walt Disney World master plan. They encompass in excess of 7,500 acres of low lying lands in the southerly and westerly portions of the Walt Disney World property. The major portion of the Conservation Area is located southeast of Interstate Highway 4 and consists of approximately 5,000 acres of the western portion of the Reedy Creek Swamp. The remaining 2,500 acres include the natural course of the Reedy Creek drainage along the west boundary of the property. Bonnet Creek discharges into a water control system canal which serves as the eastern boundary of the Conservation Area where land elevations are as low as 65 feet above sea level. The highest elevation, approximately 85 feet, occurs where Reedy Creek enters the Conservation Area nearly nine miles upstream.

Retaining as nearly as possible the existing natural water levels is essential so that inundation will continue to fluctuate within the tolerance for all existing plant and animal life. In the past, the water levels have fluctuated from almost no standing water during dry periods to as much as 10 feet of water during flood periods. The holding basin created by the six miles of levee extending along the eastern and southern boundaries of the Conservation Area will provide an increase in water storage necessary because of accelerated discharge occurring during intensive rainfall in the watershed above.

Objectives — The Disney organization in establishing the Walt Disney World Conservation Area had these objectives:

1. To demonstrate that, with imaginative planning and implementation of available technology, both present and future, urbanized development can be achieved without causing deterioration of the environment or harming the ecological balance of adjacent areas.
2. To protect areas of natural beauty on the Disney property.
3. To provide, through appropriate resource management, a wilderness sanctuary which can support the unusually wide variety of plant, animal and bird life native to the area.
4. To develop a program that will permit the public, on a restricted and closely controlled basis, to observe the subtropical aquatic environment and the wildlife indigenous to the State of Florida.
5. To provide further opportunities for Walt Disney Productions to inform and educate the public on conservation, nature and wildlife activities.

Public Use — Programs for the public which would be appropriate in specific and limited portions of the Conservation Area include:

1. Self-guided nature trails.
2. Guided canoe and electrically-powered boat trips.
3. Wildlife observation.
4. Bird watching.
5. Conservation interpretation and education, including conducted nature talks for the public.
6. Research in ecology, biology, wildlife management, etc. by conservationists and educational groups.

The intensity of visitation and public use of the areas for purposes listed above will be determined by the proximity to the vacation resort on the northwest portion of the property. Those areas closest to the recreation area will, in future years, be made accessible to the general public under closely administered visitation programs. In the portions of the Conservation Area farthest from the recreation area, i.e., the Reedy Creek Swamp, the plan will allow limited visitation by individuals and groups interested in deeper study of the environment, although the preservation and maintenance of the area's wilderness character and wildlife will be the dominant factor in management policy.

Wilderness is still an important part of modern man's needs just as it was over a century ago when Henry David Thoreau observed that "our lives need the relief of (the wilderness) where the pine flourishes and the jay still screams." ■

Rt. 1
Contoocook
N.H. 03229
11 January 72

Editor, Water Spectrum
Office, Chief of Engineers
Department of the Army
Washington, D.C. 20402

Dear Sir:

I wish to thank you and congratulate you for printing the fine article on our growing population's sad impact on our natural resources. Mr. W. M. Chamberlain did an excellent job of explaining the nature of the problem, the necessity of its solution, and possible methods of achieving zero population growth. It will be interesting to see if authors of other points of view can be as lucid and honest.

Please don't kill the important message of Chamberlain's article. Your highest duty is to the truth.

Sincerely,
Charles Kjos

As Mr. Kjos indicates, we promised to present differing points of view on the sensitive subject of population control as it relates to water resources. We concur with his point that in presenting these views our highest duty is to the truth.

We gladly accept Mr. Kjos' editorial challenge because if truth, illusive or not, is to serve as the foundation for the best policy to take, we think a good way to find it and perhaps give it concrete form is by searching through the ideas of various sources and sifting through the information on which these ideas are based.

With that in mind, we invite you to read this article on ----

"The people who are here and those who will be, must be provided for. No environmental ethic can transcend this basic precept."

Population Control: NOT a Necessity in Water Resource Management

By Col. Robert R. Werner

For the last issue of *Water Spectrum,* William M. Chamberlain wrote an article entitled "Population Control: Ultimate Necessity in Water Resource Management?" The title by implication appeared to require a rebuttal and I accepted an invitation to oblige.

Despite a neo-Malthusian tone that emerges from time to time, Mr. Chamberlain has written a thoughtful and interesting article. His theme appears to be that the rapid rate of resource use requires an even more rapid halting of our population increase. In the first part of this article he develops this theme through an analysis and evaluation of water resource management. He then moves into an exploration of the steps that could be taken to limit population growth. He concludes by providing an illustrative warning of the latent side effects of yesteryear's technological miracle, DDT.

In fact, Mr. Chamberlain's article should not be rebutted. It does, however, suggest a response; and this will be an attempt to place the subject in another perspective.

Let us look at the author's last point first.[1] He sees where ". . . *mankind has become increasingly dependent upon technological advance.*" He suggests that so far we have been able to stay ahead of Malthus, but some of the technology that has permitted a growing population has produced unanticipated and potentially disastrous side effects. The DDT that saved so many lives from malaria and increased crop yields is causing genetic damage to wildlife and also producing pesticide resistant strains of insects which, in the absence of adequate natural controls, threaten crop yields once again.

Throughout history man has sought to better himself — to survive, to improve his standard of living, to allow more people to live better. He no doubt will continue in the same vein. At times he will work against his long-run interests — perhaps never more so than when he is struggling to survive. In general, man is pragmatic and takes as long a view of his welfare as he can — as he understands his situation and can influence it. Man is constantly striving to improve his relationship with nature, and he is learning to understand that relationship more with each passing year. Yet, we are always in danger of not knowing enough. The challenge of a better, more livable world is too great to back away from in face of the risks involved; however, Mr. Chamberlain sees population pressures forcing acceptance of greater risks. He is no doubt right. It is fairly obvious that many of our problems would be simpler with fewer people, but, barring catastrophe, the world population is likely to grow for at least another century. In the interim, to improve our perception, we should separate the problems. The people who are here and those who will be, must be provided for. No environmental ethic can transcend this basic precept. While we should look to use our knowledge and technology judiciously, we should, as a current endeavor, seek to develop globally a rational approach to our growing population. This brings us to the author's second point — the argument for birth control.

The author is the Assistant Director of Civil Works for Planning and Environmental Programs, Directorate of Civil Works, Office of the Chief of Engineers.

No one can really argue against serious consideration of the population question, of some sort, sometime. The present exponential population growth curve would have us or those who follow standing shoulder to shoulder in a relatively short time in the future* — should our resources hold out — and we not manage to poison ourselves — and if we are somehow able to feed ourselves. We may or may not be able to solve these problems later once the population begins, as some like to suggest, to outweigh the earth itself.

We may not have to wait until then to solve the problem. We may not, at least in this country, even have to resort to a formal program such as suggested by Mr. Chamberlain.

Trends in birth rates are difficult to explain and almost impossible to predict accurately. This country has experienced trends in both rising and falling birth rates. The birth rate in the fifties brought forth from the Census Bureau the "AA" population projection curve to reflect the high 1954-55 level of fertility. It cancelled its "D" curve that year. Whether or not the science of population projection has evolved to the degree to merit increased confidence may or may not be the reason the current projections no longer continue on either "AA" or "A" curves alone, but include "B" through "E" series curves, the latter based on a fertility rate approaching 2.1 (the replacement rate) by the year 2000.[3] It could be that we are getting the message. In 1968 the actual fertility rate was 2.5. In July and August 1971 the rate was 2.2. In the first eight months of 1971 there were 3 percent fewer births than in 1970.[4]

These figures are cited not as an assertion that the population problem is solved, but more as a hopeful sign that man learns from his experience. Phillip Houser of the University of Chicago, for instance, has been quoted as saying ". . . the fact that man is able to consider the implications is one reason why the projected numbers (population figures) will never be reached."[5]

While intuitively we "know" that vastly increased population creates many problems, we find great differences among the views of those who appear to have given the matter considerable thought. Paul Ehrlich traces all our

* We may not be as crowded now as some would have us think. Charles Gould once pointed out that if we could put the entire population of the U. S. in the State of Texas it would not be as densely populated as the State of New Jersey — presently one of the most densely populated areas of the world. At that, about half of New Jersey is largely undeveloped and the pine barrens, a beautiful area in the southern part of the state, as unpopulated as they were five hundred years ago. He further calculated that if the entire population of the world (3.5 billion) were placed on the pine barrens — several million acres — people still would not have to be any closer than five feet apart.[2]

1. William M. Chamberlain, "Population Control: Ultimate Necessity in Water Resource Management?" *Water Spectrum,* (Winter 1971), pp. 19-23.
2. Charles L. Gould, "Pollution, Politics and Protest," pamphlet based on presentation before San Francisco Rotary Club (January 19, 1971).
3. *The Future Population of the United States,* Population Reference Bureau, Vol. 27, No. 1, (Washington, D.C.: Government Printing Office, February 1971), pp. 13-15.
4. Jack Rosenthal, "Population Growth Rate in U.S. Found Sharply Off," *New York Times,* (November 5, 1971), p. 25.

environmental ills predominantly to too many people and sees the population of this country as too large already.[6] Many agree; but some others equally as prominent don't. Jesuit James Schall has been quoted as saying that birth control limits our capacities and our future. It puts limits on our intellectual base that could help us provide for a more complex and technologically advanced society. Schall asserts, "We do not know what man can be."[7] Ben Wattenberg, White House demographer, sees no optimum population. He feels that it is more important what we do about our problems than how many people we have.[8]

The population problem is widely recognized however. India has been trying to do something about it for almost twenty years now (with little statistical evidence of success). In recent years Peking has encouraged later marriages, use of birth control pills and other measures.[9] Houser, for one, appears confident that zero growth will come and that the only questions are how and over what time period.[10]

Sociologist Dudley Keik points out that with a higher standard of living people realize they don't have to have eight children for three to survive. They will seek fewer children and have higher aspirations for them.[11] That viewpoint is usually moderated somewhat because as a recent phenomenon it appears that as the standard of living rises, and people become better off, they tend to want more children. Jay Forrester notes that improvement in the standard of living and increased food supplies could trigger a resurgence of population growth.[12]

I agree with Mr. Chamberlain that a population growth problem exists and although there is no absolute agreement on its nature or extent or how it ought to be solved, there are indications that man has become aware of his problem and is responding. I have introduced the idea that the urgency for an immediate, government-sponsored solution is not so great as some would have us believe. Man has to continuously assess his situation and make his decisions. Many are convinced that man, when confronted with a need, even under pressure, is pretty resourceful in finding a solution. Miller sees hope in "creative urgency."[13]

5. Otto Friedrich, "Population Explosion: Is Man Really Doomed?" *Time*, (September 13, 1971), p. 58.
6. Paul R. Ehrlich, *The Population Bomb*, (New York: Ballantine, 1966), pp. 66-67.
7. "Is Ecology Heresy?" *Time*, (September 13, 1971), p. 30.
8. Friedrich, *op. cit.*, p. 59.
9. *Ibid.*, p. 58.
10. *Ibid.*, p. 59.
11. *Ibid.*
12. Jay W. Forrester, "The Computer and Social Catastrophe," *Intellectual Digest*, (October 1971), p. 60, reprinted from *Technology Review*.
13. Maynard Miller, "The Environmental Crisis — What Is the Question?" *Army Research and Development*, Vol. 12, No. 3, (April-June 1971), p. 34.

This brings us to the resource problem and the question of how sharply the population growth problem impinges on man, in this country, at this moment.

Mr. Chamberlain is concerned over what many others also find intuitively obvious. We are using resources at a frightening and accelerating rate. And if the United States is using 40 percent of the world's resources, what happens as the world's population grows? What happens as underdeveloped nations seek to improve themselves? Again the mind boggles. Again there are differing views.

Many seem to agree that we have been profligate in our use of resources. We probably have. Some feel as Miller indicates that we ". . . have no right to blow 4 billion years of natural resources development on our earth in something less than 150 years... ."[14] Others see larger known reserves of gas and oil now than two decades ago with the age of nuclear power just beginning.[15] This latter thought is important because oil is presently the source of the greatest portion of our energy. And energy our civilization must have. Given adequate supplies of energy there seems to be little that cannot be accomplished. With more energy — more effort — many other resources can be reclaimed, recycled or made to work longer rather than thrown away.

We can expect life styles to change over time. Do we see and do things now as we did a century ago? Dwindling energy availability in the future could drastically change our culture. And energy sources as we know them today cannot be regarded as infinite.

Backing off from that imponderable somewhat, what of water resources management? We know there is an energy resource depletion aspect of the water use problem (desalting and basin transfers require energy). We know that there is a cost-value relationship that is somewhat out of line. We do not pay full costs — some are passed on to others or to the world as a whole rather than borne by the developer-preserver-user. Assuming an infinite supply of oil exists does not help balance the equation. Assuming some specific finite supply is not real does not help much either.

Having discussed Mr. Chamberlain's issues of the misuse of technology and the need for birth control, we can now try to approach the water resource questions without those exacerbating implications. In many respects he has a clear view of the problem. Some of his views however, appear more "popular" than accurate. I would also stipulate that barring catastrophes, zero population growth is not likely to be reached in less than 60 to 70 years under *any* kind of program.

14. *Ibid.*
15. Friedrich, *op. cit.*, p. 58.

Again let me say I have no real quarrel with Mr. Chamberlain. He believes in the need for a birth control program and he has attempted to support his argument with observations drawn from the water resource field. While I may or may not agree with his views on birth control programs, as a serious practitioner in the water resource management field, I prefer to view our water problems in as objective a light as I can. Let us look at some of the points raised by Mr. Chamberlain that appear to need some clarification.

For one, he says, ". . . *within a few years nearly all known fresh water supplies in the United States will be fully utilized.*" The United States has abundant supplies of water and with proper management "water supplies" should be adequate to support double or triple the present population at the present or even higher use rates. This is a very general statement, of course, and needs both qualification and clarification. Not all water is available where we would prefer it, at the times we would prefer it or in the quality we would prefer it. But this is no different from the situation in other resources.

This Nation has and will continue to ship water where it is needed; we have and will continue to store water at times when it is plentiful for use when it is less so. This makes good sense if we recognize two things. We should know and be willing to pay the full cost when we store or ship water. We should understand that water has many functions in many ecosystems; the effects on these systems throughout the length of the waterway must be examined and evaluated. So far as quality is concerned we are just coming to the realization that no city or industry has a "right" to change the quality of a waterway to the detriment of later users whether those users are affected directly at their water systems intake or indirectly through adverse effects on fish and wildlife. When we recognize this we can make our waterways indefinitely reusable, whether accepting re-use of water 17 times as it flows down the Ohio River or the type of recycling practiced at Muskegan, Michigan, which places waste water higher in the watershed to provide "living filters" treatment on the land before allowing it to flow back through the stream and eventually into a city's water treatment intake system. With full recognition of these factors, we are not about to find our water supplies fully utilized (in the sense of being totally consumed or expended) in the near future.

". . . *this*[16] *suggests to many that economic growth as we know it is also incompatible with conservation of water supplies.*" If we are talking in terms of economic growth that exploits resource use and disregards costs that are put on others, which we call external effects, this is perfectly true.* We cannot and are not continuing in this vein. We cannot correct what we have done in the past in a short period of time; in some cases we may never be able to; or perhaps we may decide we do not want to. We cannot even correct improper practices in a short period of time.

But we are not merely giving lip service to the idea of change either. Look at it in terms of the water quality standards that municipalities must meet and the effluent permits required of industry that will insure conformance with the same standards. There are other comparable examples. Brought into this context there is no reason why economic growth could not continue. "Growth" should be construed not as an end in itself but as the drive of a society to improve itself — improve the welfare of its members.

". . . *there is no guarantee that technological breakthroughs will occur when we need them, it is dangerous to count on them.*" This is true, of course, and it comments on a manifestation of unenlightened positivism that we often encounter in extremists of all varieties. So far as water resource management is concerned we have the science, and in many cases, the practice and the institutions, to meet our needs for the indefinite future. Breakthroughs may come and could be helpful. We would not be in a bad position, however, if we merely are required to employ what we now have in our books and in our experience.

In reference to ground water replenishment, Chamberlain cautions: "*But note that this incredible waste of effort would never have been necessary if the Los Angeles Basin had not become so heavily populated that demand for water exceeded the sustained yield capacity of the ground water resource.*" While ground water replenishment may or may not be wasteful, much of Los Angeles' water supply comes from areas outside its basin — from the Colorado River and Northern California to cite two. There has been much written about this overindulgence of the Angelinos, also.

Leaving the environmental effects of transferring water from one basin to another aside for this discussion, Los Angeles is different only in degree from other major cities. Few cities are sited so fortunately as to be able to draw all their supplies from their own wells. Most are dependent on water coming from other parts of the basin in which they are situated or from other basins. New York, San Francisco, and Denver are a few more examples. Should a city be limited by its own resources? Environmental effects aside, should water be treated differently than other resources or products that all communities "import" to subsist? It isn't *whether* this is done, but *how* it is done and *what* is done with residuals that are critical to us now.

". . . *urgency at the planning stage. . . would not exist either if construction of high dams and aqueducts could occur overnight or if the population were not growing.*" This is sort of a curious statement; but it was made in a context explaining the normal difficulty in planning is made even worse by population increases, and it does afford an opportunity to talk some about planning.

How do we achieve solutions to meet our water needs? We do it by planning. The function of the planner is to reconcile the needs, the desires and the objectives of society with what is possible — in this case the many and varied uses of the water resources. While

16. Chamberlain, *op. cit.*, pp. 19-23. * Examples include unreclaimed strip mines, polluted rivers and polluted air.

not all planning is good or successful, it is nonetheless an essential element in the decision making process.

Serious planning to meet the water resource needs of this country, although expanded greatly in the last quarter century, is not even of 20th century origin. George Washington and others were involved in water transportation schemes — such as canals — in the late 18th century. In the long run, Washington's Powtowmak Canal was a financial failure.

Perhaps the first major planning endeavor was the national plan of Albert Gallatin. Gallatin, then Secretary of the Treasury, was commissioned by Congress to determine how the country might be made more cohesive as population and interests began moving from the East Coast to the west — west of the Appalachians. Gallatin proposed a plan to the Congress in 1808 to unify the country and promote commerce and communication through road and river development — the improvement of routes of communication. The plan was periodically updated and used as a guide for over one hundred years. Inland and coastal navigation development played and has continued to play a major role in the growth of this country as we know it today.

In the early days of this country whether we realized it or not we traded our natural environment — resources — for faster economic growth. Now there are some who would have us trade economic and population growth to save our natural environment. It does not have to be an either-or situation if we act rationally. We sometimes hear of economic growth and development spoken of as if they were ends in themselves. To some perhaps they are, but to the Nation as a whole the goal is the public welfare — a better life for as many people as possible. Most are concerned with man's welfare in the long term as well as the short term. If we can bring all of man's concerns, near term and long term, properly weighted or priced, into the calculus, we can come up with better decisions in terms of overall general welfare. This is what the relatively new upsurge of concern for population controls, the environment and planning has to be about. We are adjusting our scheme of values.

There is plenty of land and plenty of water in this country, a blessing we have not overlooked. In fact we have tended to treat our land and water as virtually free goods in the past. It is the lack of adequate economic price being placed on these resources in the past that caused much of the problem that we are faced with today and that faces us in planning for the future. When we do not pay the full price for an item we tend to use more of it in relation to other goods than we should. When we talk about man's needs for water or any other goods, the tendency is think in terms of present day use-rates and to project these into the future.

We should really be thinking in terms of man's demand for water in the economic sense — the schedule of amounts of the resource in its various forms he will "buy" at various prices. Resource use implies an effect on the environment. If a good is free or not fully priced, the external effects of resource use can be undesirable. By "external effects" I mean in this case, the use of water resources in such a manner as to produce an economic effect on other uses without due compensation. Polluted rivers is a prime example. Other uses include those related to lands and rivers we now consider to have been of value and the losses of which everyone belatedly regrets.

There are some who feel that water resource development policy should have as its explicit objective the controlling of population increases in certain parts of the country and, perhaps, for the Nation as a whole. This is an intriguing proposition, but one that the resource agencies tend to shy away from.

In making population projections for water resource planning, it is often assumed that water is not a crucial factor in the expected development of the region. That is, water will not hinder growth by being (relatively) more scarce nor encourage growth by being more plentiful than is presently the case. Water is kept neutral.

Some feel that the availability of water *is* a major factor in population growth and that this Nation should guide planners in limiting the growth of regions of the country. Such an approach may be somewhat less useful than advocates would prefer to admit. Whether a particular group of planners provides for the needs of a population or not, society as a whole is well aware of resource availability and the technological tools by which resources can be made available.

Plans that do not provide for the needs of a population cause precipitate acts that cause far more damage than well planned development. A population that has been hurt by a water shortage or blackout or disastrous flood will react instinctively and blindly to solve its problems in the shortest possible time — with little concern for long-term consequences or considerations, such as what the cost may be to the natural environment.

A region may wish to limit its growth to a comfortable size by not expanding its water supply. An effort of this sort, alone, can be self-defeating. Unless some other means are taken to keep newcomers out, all will share the shortfalls as they develop. Deliberate failure to provide an essential service is unlikely by itself to achieve the results intended.

It appears unrealistic to expect radical changes in public policy that would represent a diminishing of such concern by a Nation for its people. It does not seem that water resources and the natural environment are presently perceived to be in such an acute situation as to justify such course of action. Nor do foreseeable prospects for a population double that at present support a "viewing with alarm."

Objectives that were of prime concern to us years ago seem less important to us now — less important at least in that there are other considerations that are gaining equivalent ranking. This is hardly startling. Man has always been able to rank his needs. Subsistence and security come first. As fundamental needs are met more attention is given to the social, cultural, and aesthetic needs. In other words, we are sufficiently affluent — on balance — to become concerned with the quality of the natural environment, policing up our campsite and looking to our long-term future. This means modified values, a new appreciation of the old economics and new ways of doing things. These reforms are buoyed by a young and concerned population and a dynamic economy. It does not necessarily have to be this way. The will to reform could broach on an economic recession.

The arrogance of some reformers is hardly becoming. The smugness and resistance to change of those whom the old methods suited is no more appealing. The problem is as it ever was, giving the situation the benefit of our best knowledge and making the wisest decisions we can afford to follow through on.

We don't make progress in fits of pique or by arriving at the "I-got-mine; let's-close-it-off-right-here" stage. We have to apply to the future what we are applying to the present. We have to project. We have to plan for the future. We have to provide for the people who will be here next generation and the generations after that. If we choose to take a frugal view of our water resources, they will not thank us if they see things differently or technology is (even) kinder in providing solutions.

Limiting population through limiting water supply is a harsh solution. Essentially it provides a feedback through increasing discomfort that presumably forces a population to protect itself from further increase in order to survive at some acceptable standard of living. The cause and effect path is tenuous and, as mentioned earlier, is not at all assured of effectiveness.

It would appear that other means to effect a population philosophy or policy must be more effective. If that thought were accepted it would be well to recognize that until (and if) the population stabilizes we must provide for the future even as we have been provided for.

It is not too early or too difficult to introduce the economics that will place more realistic prices on water, energy, and the natural environment itself. In fact we are doing this — with Federal agencies contributing a large share of the effort as their programs reflect the changing public interest.

Neither the would-be dam builders nor the dam damners speak for the country as a whole, but they both present views that must be heard and considered. There is no indication that this is not being done and the public interest is not benefiting nor evolving from the dialog.

Mr. Chamberlain has permitted me to use his article even as he used water resource management as a vehicle for his views, and he deserves the opportunity to respond in turn if he wishes.

We have large and important problems facing us and we must and can solve them. The solutions will be good ones only when we bring to them our best, most enlightened and objective efforts. I appreciate the opportunity to join with Mr. Chamberlain in attempting a step in this direction. ■

Events, Deeds & Deliberations

To Bury or Not To Bury

The old adage "out of sight, out of mind," seems to be the guiding spirit behind the urge to pump pollution underground.

But U. S. Geological Survey hydrologist Donald R. Rims doesn't approve of this concept as a means of bypassing the congressional restrictions on discharging wastes into surface waters as described in the 1966 "clean waters" bill. Rims contends that forcing wastes underground merely means turning over their custody to nature.

Possible hydrological consequences include contamination of subsurface fresh water reservoirs and even the triggering of earthquakes. The latter comes from forcing wastes into the subsoil through pressure that was not originally present and the insertion of materials that act as lubricants among the underlying rock faces.

The idea of drilling wells to remove industrial byproducts has been followed in this country since the early 1950's. Since then hydrologists have found these underground waste pools do not sit still. They migrate and may come back to haunt man at a later date.

This is not a one-sided picture by any means, for hydrologists find that underground pumping also has its good points. For instance, the underground addition of water from the surface has greatly reduced surface subsidence in the Santa Clara Valley, where as much as 13 feet of subsidence has been recorded at some points. This phenomenon was a consequence of overpumping the Valley's ground water between the years of 1917 and 1968. Such incidents are common to many parts of the world as a result of pumping out subsurface oil and water deposits.

Thus, the future of underground disposal is closely linked to the acquisition of more knowledge about nature's underground plumbing systems and how injected wastes affect them.

Water Hyacinth: Weed or Winner?

Never considered a friend to those who navigate southern waterways, the pesky hyacinth may be due for praise among those interested in combating water pollution.

Auburn University graduate student Hugo Rogers reports that his research shows the water hyacinth removes large amounts of fertilizing agents — especially phosphorus and nitrogen — from the medium in which it's grown. If that medium happens to be sewage effluent, the result is the removal of two of the major pollutants.

Rogers found that an acre of water hyacinth could absorb the daily nitrogen and phosphorus wastes of about 450 people. Therefore, using the water hyacinth to remove these excess nutrients from the effluent could either slow down or reverse the natural process of eutrophication, accelerated by heavy dumping of effluent into lakes and streams.

Rogers' research work was under the direction of Dr. D. E. Davis, Department of Botany and Microbiology, at Auburn's School of Agriculture and Agricultural Experiment Station.

Plans Dropped for Waterway Extension

The idea of extending the Gulf Intracoastal Waterway 42 miles between Carrabelle and St. Marks has been dropped in favor of preserving a unique ecological area of Florida.

A Corps of Engineers authorization called for dredging a navigation channel through Alligator Harbor, St. James Island, Ochlockonee Bay, Ochlockonee Point and Apalachee Bay. But comments from conservationists and governmental agencies on the draft environmental impact statement prepared by the Corps' Mobile District pointed out the seriousness of the environmental disturbances that would result from the proposed construction in the Alligator Harbor-St. James Island area. Most of this area is considered a vital habitat for finfish and

shellfish harvested by commercial and sport fishermen. Alligator Harbor, specifically, is recognized as high in both biological productivity and scientific value.

Several studies and estimates completed by the Corps indicate that alternate routes would have similar environmental impact, provide even less protection to navigation and would not be economically feasible.

The Delicacy of Underwater Chemistry

Communication through chemicals may explain a fish's knack for relocating its home stream after each migration. A group of researchers at Woods Hole Oceanographic Institution is studying the sensitivity of fish to chemicals in the water, claiming that this sensitivity in fish is comparable to the sense of smell in land animals.

Using alewives, the researchers found the test fish always could pick out ther home stream from other streams placed alongside it in a *Y* maze. This is the type of experiment where water from the home stream was placed into one arm of the *Y* and water from an adjacent stream into the other. Even when the chemical differences were slight, the alewives could distinguish their home stream from the nearby stream each time.

In another study, the Woods Hole group examined the effect of placing kerosene-soaked asbestos strips into a lobster tank. The kerosene disrupted the normal behavior pattern by increasing stress reactions, grooming activity and aggression toward other lobsters. Furthermore, the lobsters ate the asbestos strips, indicating how easily aquatic animals living near oil pollution may become contaminated and unfit as a source of human food.

Feasts for Fish?

A University of Texas marine scientist has publicly described many sewage pollutants as nourishing feasts for fish rather than poisons. However, he cautioned, this premise requires proper distribution of sewage material in a correctly managed program.

Dr. Carl H. Oppenheimer, director of the university's Marine Science Institute, urged the Texas Water Quality Board to make a statistical analysis of Gulf Coast fish catches to determine if water quality changes might not be beneficial in some cases to fish productivity. "Sensible management," he pointed out, could then "come in and separate positive from negative pollutants."

Many industrial byproducts are actually nonharmful nutrients in their present state, Dr. Oppenheimer explained. On the other hand, he added, many sewage materials highly toxic in a concentrated form could become nutrients when diluted. For example, most of the antibiotics and many of the heavy metals will stimulate fish populations at very low concentration levels.

An official of the board concurred that the number of fish landings has risen in proportion to the exercise of pollution control in Houston Ship Channel and Galveston Bay. It's a matter of balancing pollution against seafood productivity, according to the board spokesman.

Drum Inlet Reopened With a (Big) Boom

An earth plug in the outer banks of the North Carolina coast abruptly disappeared with the help of 26 tons of explosives and Drum Inlet was once again open to small-craft navigation and salt-water circulation.

Located south of Cape Hatteras and 24 miles northeast of Cape Lookout, Drum Inlet was created in 1933 when natural forces opened a channel between Core Sound and the Atlantic Ocean. After 37 years the same natural forces closed Drum Inlet in December 1970. One year later, on December 23, a manmade force reopened it by blasting out the remaining earth plug after a two-mile long connecting channel had been dredged inside Core Sound.

Four days after the manmade assist, nature had already widened the new pilot channel to 800 feet, averaging two to three feet deep with the exception of a six-foot channel on the northeast side. Supplemental dredging by the Corps of Engineers expanded the new inlet to meet design depth and width dimensions.

All material dredged from the new channel through Core Sound and Drum Inlet was placed to the north of

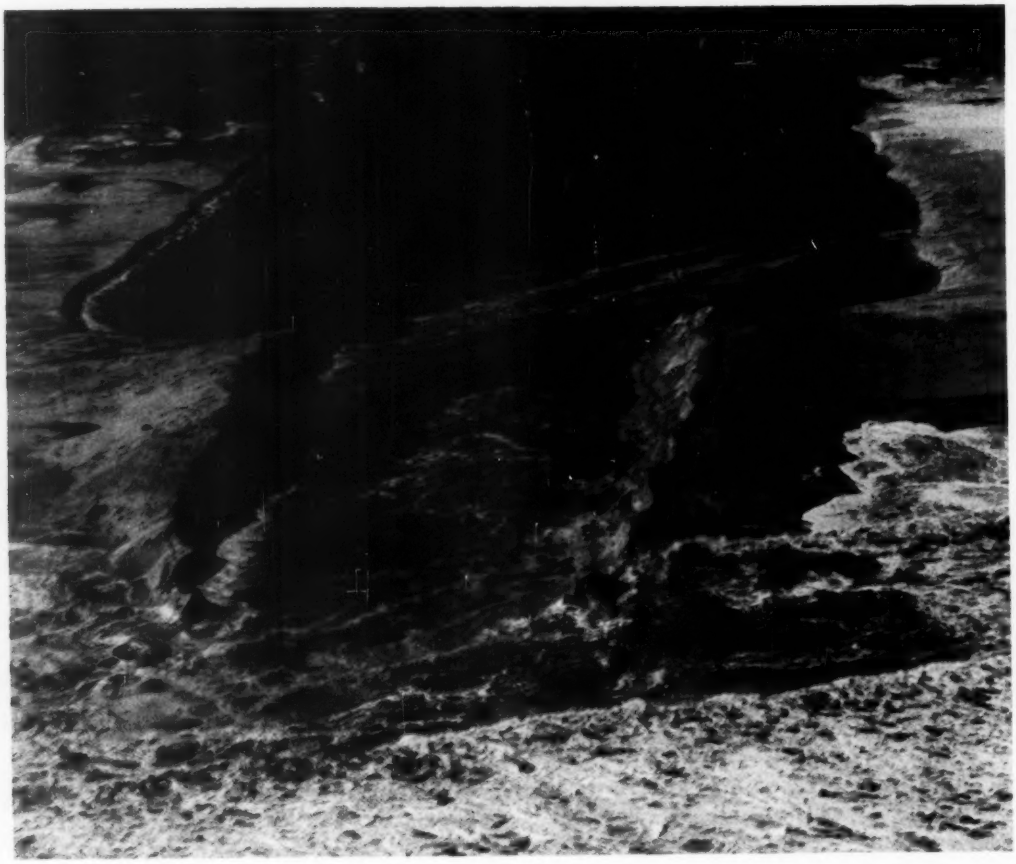
A fire in the hole once again allows Atlantic Ocean salt water to circulate through Core Sound on the outer banks of North Carolina.

A towering geyser of water and spray, set off by 26 tons of explosives, carries the remnants of the earth plug skyward.

the new coastal opening to form the foundation of a new marsh area. This area is now being planted to create 30 acres of marsh grass under the direction of Dr. W. W. Woodhouse of North Carolina State University, who is performing the work under contract to the Corps' Wilmington District office.

The twofold purpose of planting marsh grass next to the inlet is to stabilize the new channel and to create a natural habitat for fish and wildlife. The biological

aspects of the new inlet are being coordinated with the North Carolina State Department of Fisheries, while the effects of the new Drum Inlet on the environment and adjacent beaches will be monitored by the Corps.



Drum Inlet reborn.

Air Compressors Inject Life Preserving Oxygen

Missouri's trout-stocked Lake Taneycomo in the heart of the Ozark Mountains tourist center has been receiving steady injections of life-preserving oxygen to prevent fish suffocation. This unusual experiment is being accomplished by 10 large air compressors leased by the Corps of Engineers to aerate the subsurface waters flowing through the hydroelectric power turbines at Table Rock Dam and Reservoir.

The first sign of danger to the trout, grown in the State hatchery a few hundred yards below the dam, was observed during the fall of 1970. Due to unusually damp and cloudy weather with little wind, the dissolved oxygen level of Lake Taneycomo went below the acceptable minimum for over 35 days, an abnormally long period.

The problem was handled on an emergency basis that year by dumping water over the spillways of Table Rock Dam to aerate the water feeding into Lake Taneycomo downstream. However, this method of aeration could not be continued as a regular practice due to the power-producing requirements for operation of the dam.

As an alternative, the Corps rented two 1,200 cubic feet per minute (cfm) and eight 900 cfm air compressors the following year. These machines now remain lined up behind a clump of trees below the earthen embankment section of the 252-foot-high dam. Each compressor is hooked into a single manifold ending in two discharge lines.

One of these lines is connected to two six-armed air diffusers placed 185 feet below the surface of Table Rock Lake behind the dam. Each of these air diffusers is 80 feet across. The other line discharges into the water piping used to flood the penstocks, or water passages, feeding into the turbine intakes.

This unique aeration project began October 1, 1971, with a two-month run of just the two 1,200 cfm compressors. These compressors were used to inject air directly into the water that passes through two of the four 50-megawatt turbines in the power plant. Resulting changes in the dissolved oxygen content were recorded at various locations along the river bank and from small boats stationed above and below the dam. The biologists, engineers and other technicians operating the monitoring equipment also recorded changes in temperature and organic content.

This first test run raised the dissolved oxygen content of the water below the dam from 4 to 6 parts per million (ppm). With such proof of its success, this technique was expanded to simultaneous use of all 10 compressors, the volume of compressed air

ORDER FORM

To: Superintendent of Documents,
Government Printing Office,
Washington, D.C. 20402

FOR USE OF SUPT. DOCS.	

The enclosed $..... (check or money order) is for my subscription to the U.S. Army Corps of Engineers quarterly magazine WATER SPECTRUM. ($2.50 a year; 75 cents additional foreign mailing.)

Name _____

Address _____

City, State, and ZIP code _____

required being dependent on the dissolved oxygen level readings taken from the monitoring instruments and the rate of discharge from the power producing turbines.

All of the portable compressors leased by the Corps were originally designed for urban construction use where noise pollution level has become an increasing concern. Only manufactured since 1968 these low-noise compressors operate at approximately one-hundredth the noise level produced by conventional compressors of comparable size.

According to the resident engineer, Richard B.Groves, this relatively noiseless compressor was sought out by the Corps so that the large numbers of autumn campers and fishermen, some as close as 1/4 mile away, would be unaware of any interruption in the serenity of the surrounding woodland they come to enjoy.

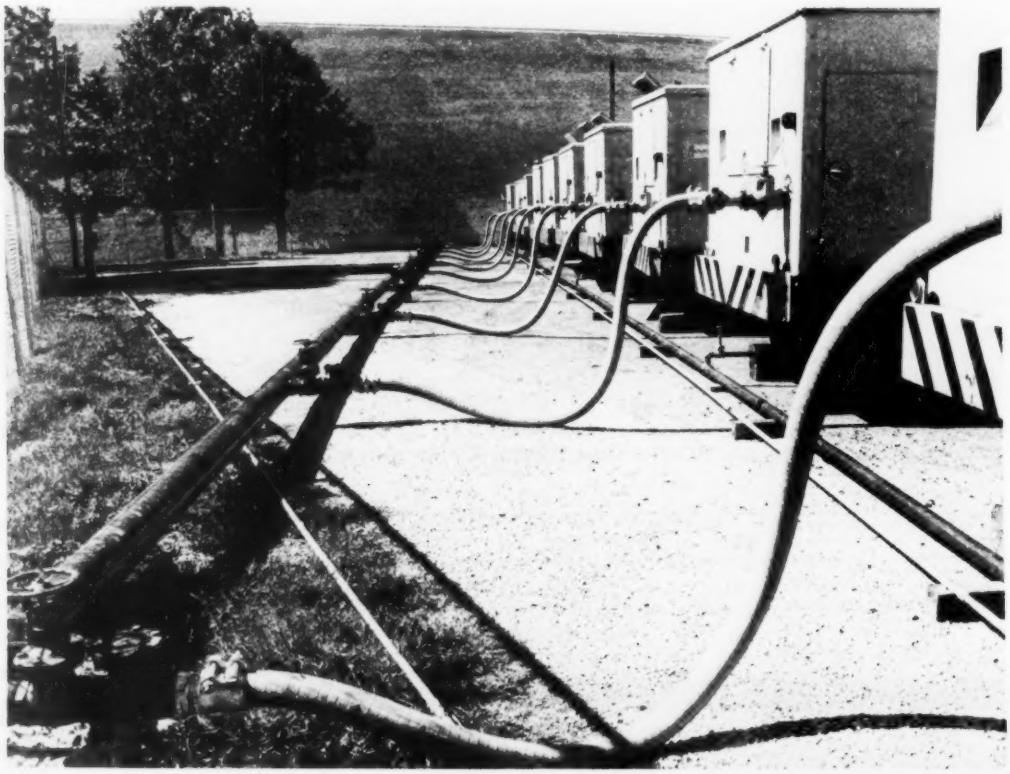
The problem was originally called to the Corps' attention in October 1970, when the dissolved oxygen level in Lake Taneycomo started falling below the 4-ppm minimum which the Missouri Department of Conservation considers critical to sustain trout life, and well below its recommended 6-ppm level.

This unusual condition can be traced back to a fact common to large bodies of water. Covering 52,300 acres up to a depth of 230 feet, Table Rock Lake waters are vast enough to separate into internal layers dictated by differences in temperature. During summer the warmer surface waters build up a much higher dissolved oxygen content than the colder layers of water at greater depths. With the coming of fall the surface layers begin to cool and sink, displacing the relatively oxygen-starved cooler waters at the lower depths.

As the displaced cooler waters are forced upward, they eventually rise to the 140-foot level where water from Table Rock Lake is drawn into the turbine intakes and discharged downstream into Lake Taneycomo.

The difference last fall was that this oxygen-poor water had its dissolved oxygen content charged up with life-giving jets of air before reaching the turbines intake level for Table Rock Dam.

Compressors send air through diffusers placed 185 feet below the lake surface, aerating the water before it goes through the turbines on its way downstream.



DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY

This scallop bed is in 10-foot water behind an estuary enclosure of the Dutch Deltaproject. *See page 1 for story.*